

2-05-09
Overview:
Biomass
Energy in
Alaska

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in Alaska</subject><comm>SENE26</comm></target>

Developing Alaska's Biomass Resources

Presented by: Gwen Holdmann, Director
Alaska Center for Energy and Power



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Alaska Center for Energy and Power

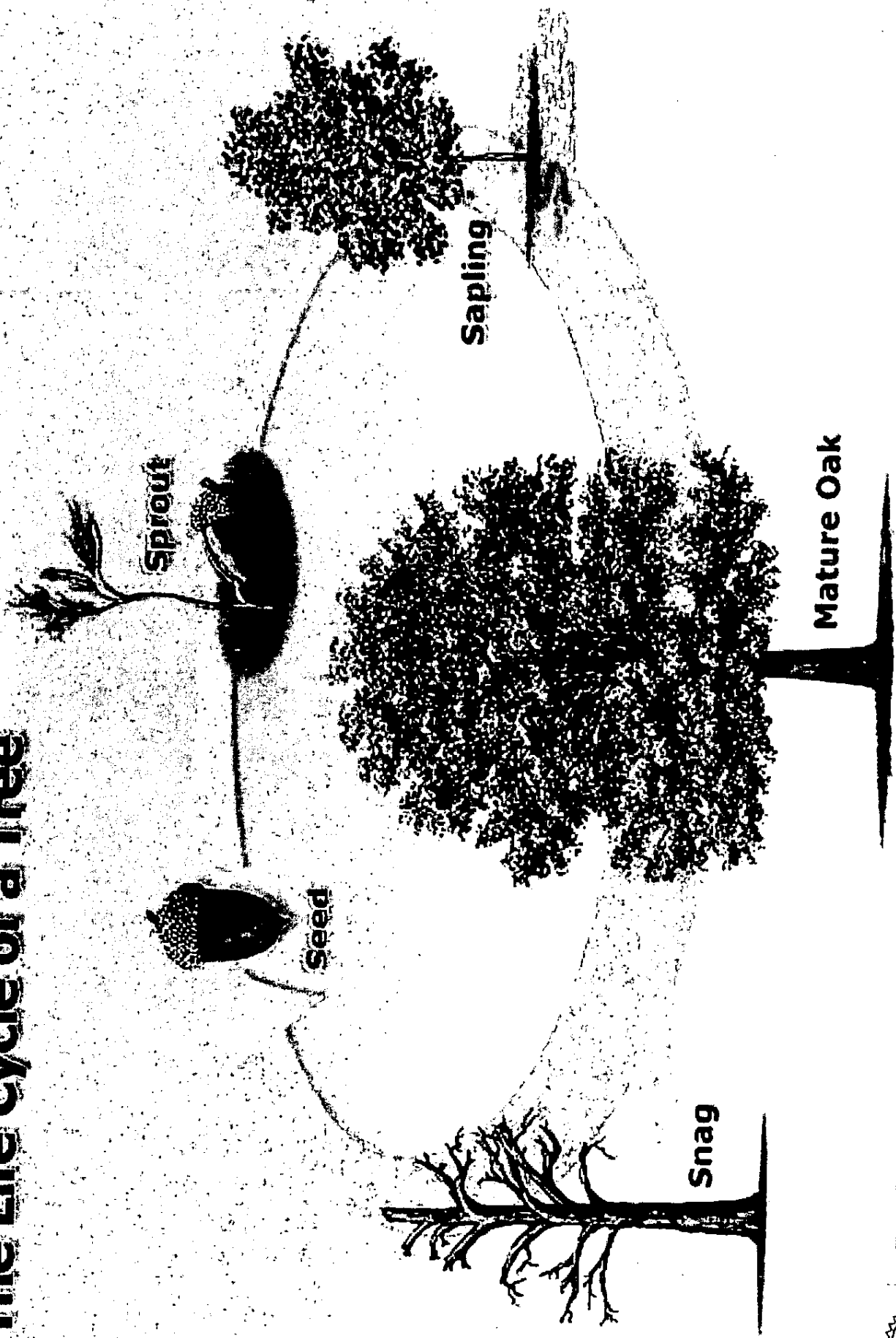
*Fostering innovative solutions to Alaska's energy challenges
through applied energy research at the University of Alaska*

Biomass Resources

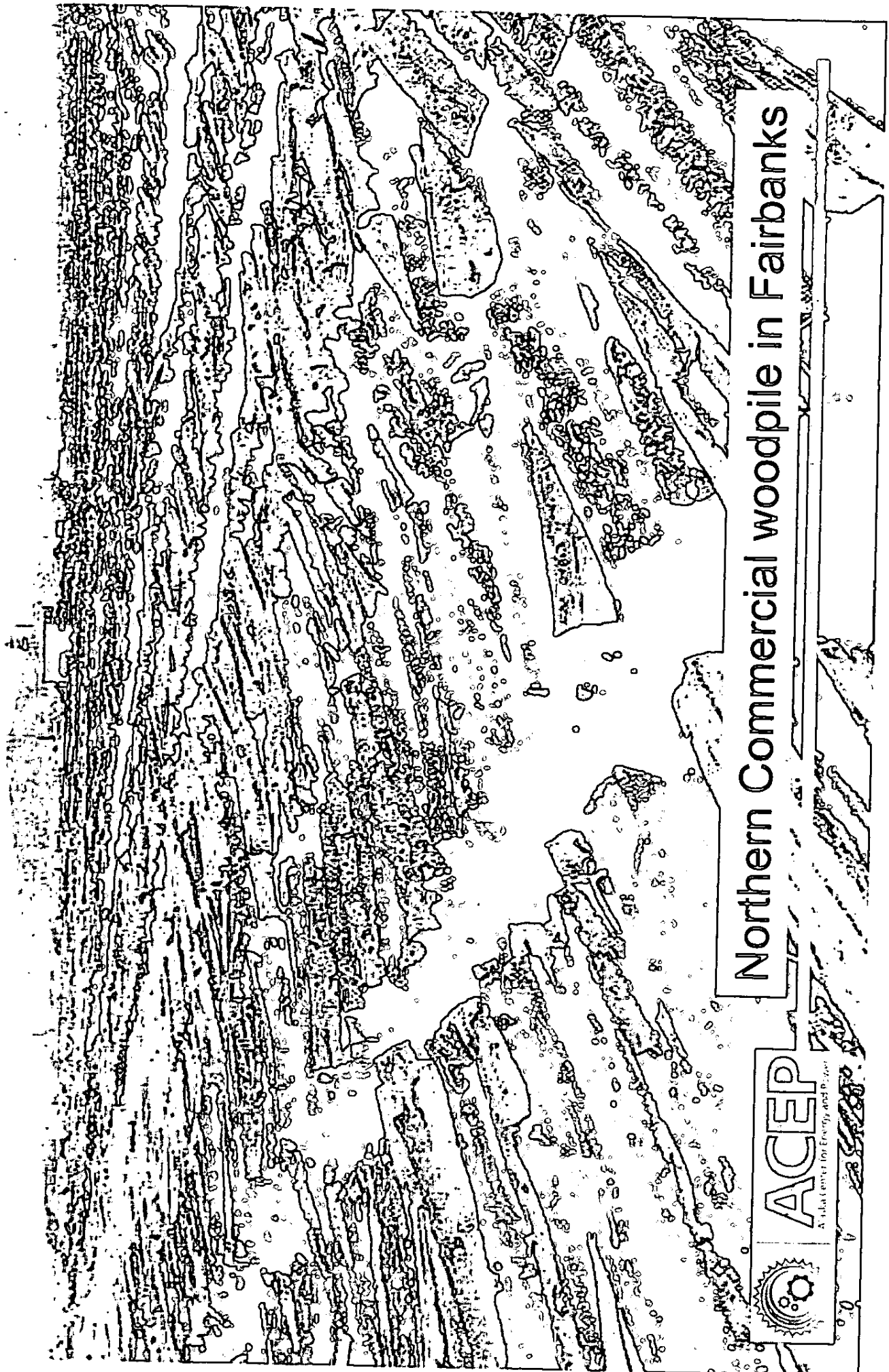
- ▼ Harvested timber (round logs)
- ▼ Residue and waste from sawmills
- ▼ Fish oil
- ▼ Municipal waste
- ▼ Energy crops
- ▼ Algae
- ▼ Methane



The Life Cycle of a Tree



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Advancing Energy and Power



Northern Commercial woodpile in Fairbanks

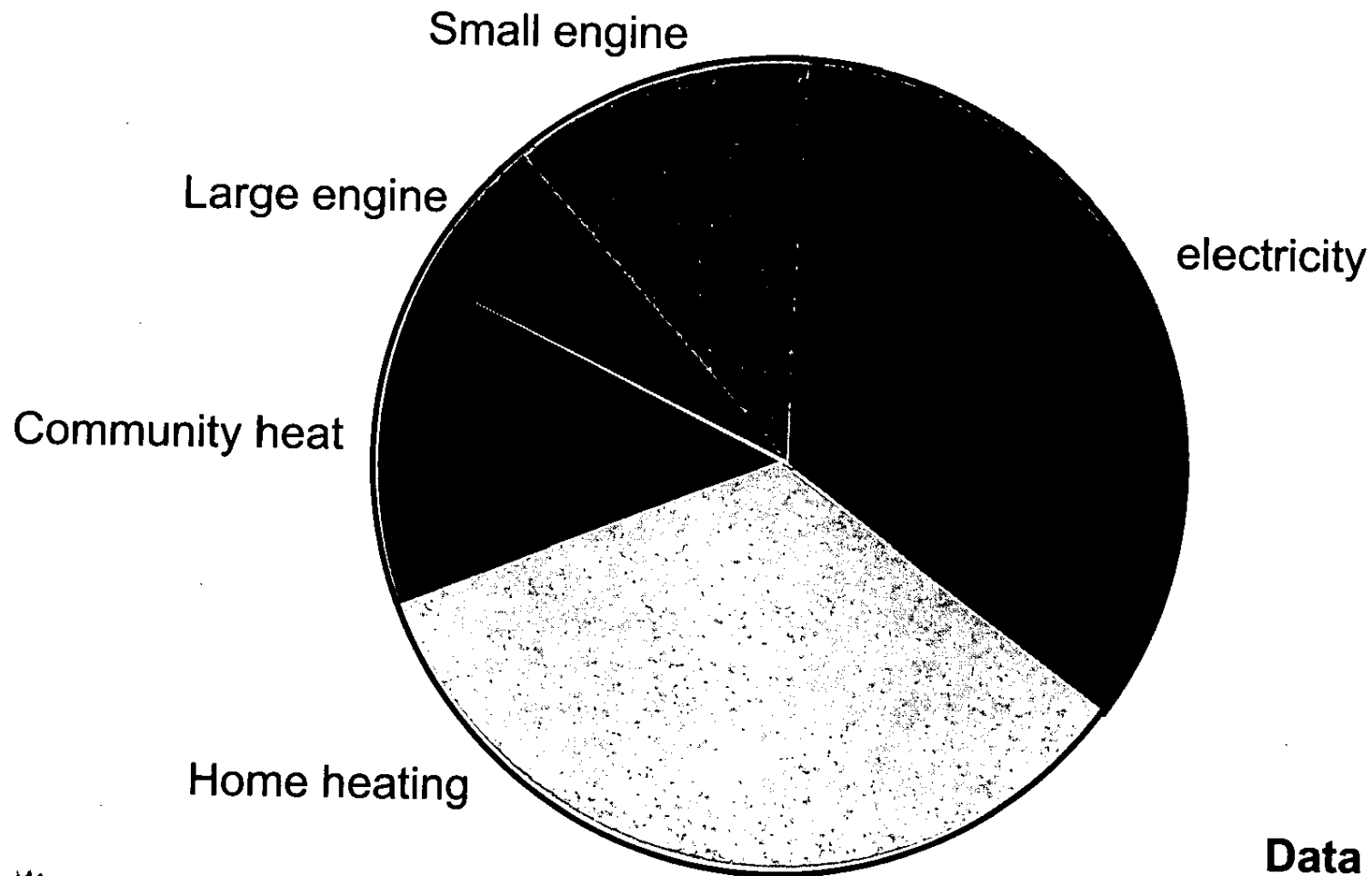


Advantages of Biomass

- ✓ Can supply on demand, base load power
- ✓ Available year-round with storage
- ✓ Carbon neutral
- ✓ Can be processed into a syngas or liquid fuel
- ✓ Can be used for power generation, space heating, and transportation applications



Energy Input in PCE Communities



Data from ISER/UA



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Austrian Center for Energy and Power

Disadvantages of Biomass

- Expensive to handle, low energy density
- Must be utilized near its source
- Labor intensive
- Bulky, storage can be a challenge



Biomass in the Lower 48

- ▶ The use of biomass has achieved widespread acceptance as a power source
- ▶ Typical technology is biomass-fired boilers and Rankine steam cycle for power generation
- ▶ Resource includes landfill gas, MSW, wood & wood residue
- ▶ EIA data indicate that in 2006, net summer capacity for biomass totaled 9,910 MW (~1% of total U.S. generating capacity)



Biomass use Worldwide

- ▶ Primary energy source for $\frac{1}{2}$ of the world's population
- ▶ Europe is a leader in clean technologies
- ▶ A variety of generation technologies being utilized
- ▶ India also a leader



2 MW plant in Güssing, Austria



Research Challenge

- ▶ Reduce capital costs
- ▶ Improve efficiency of energy conversion (the smaller the system, the inherently less efficient)
- ▶ Lower emissions
- ▶ Improve integration with existing generation systems



Gasification vs. Direct Combustion

- Incomplete versus complete combustion to form a syngas
- Gasification can be more efficient than direct combustion
- Very little industrial scale gasification being done
- Main challenges are economic and integration with downstream processing applications, also difficult to achieve optimal performance for varying fuel conditions



Biomass as a crop

- It would require approximately 500 acres to grow a biomass crop to fuel a 500 kW generator, assuming production of 5 tons/acre/year
- Biomass crops are fast growing crops grown specifically for energy generation
- High cost of production relative to fossil fuels, but more of the money stays in the community
- Chicken and egg problem – what comes first, the crop or generation facility?



Biomass as a crop

- It would require approximately 500 acres to grow a biomass crop to fuel a 500 kW generator, assuming production of 5 tons/acre/year



The Opportunity

- Alaskan rural communities represent a high value niche market for emerging technologies
- Alaskan villages could provide global leadership in rural biomass power systems
- There is a niche market for small (100kW to 5MW) modular biomass power systems



Experience in Alaska

- △ Co-firing in coal power plants
- △ Phytoremediation
- △ Revegetation
- △ Landfill caps
- △ Bioenergy crops



Eielson Recycling Program
densified 1500 tons per year
of waste paper and cardboard
discontinued in 2006



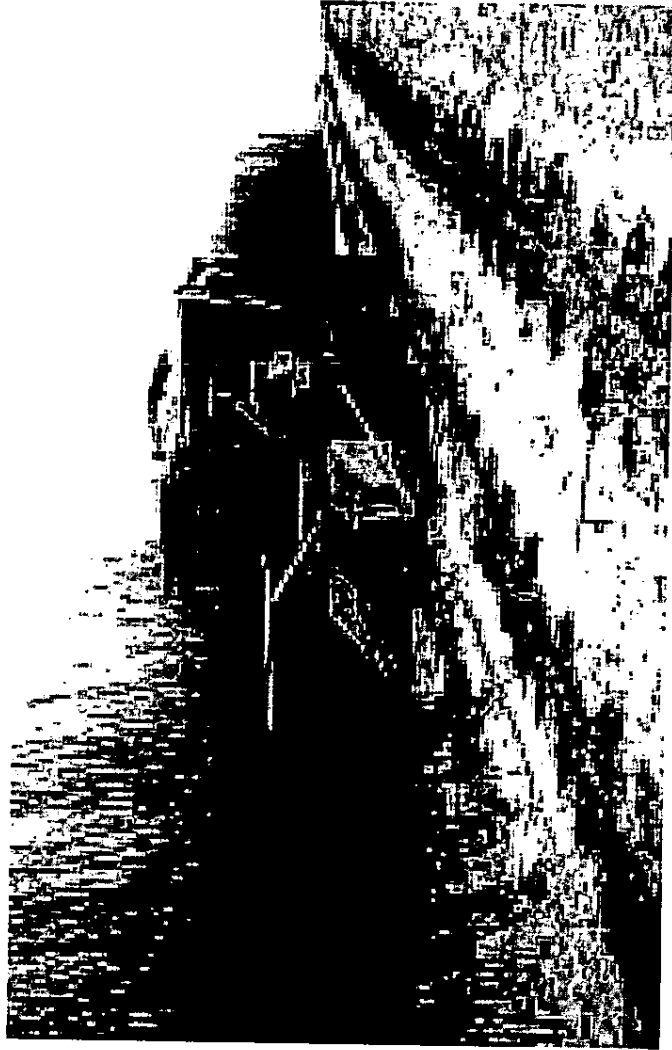
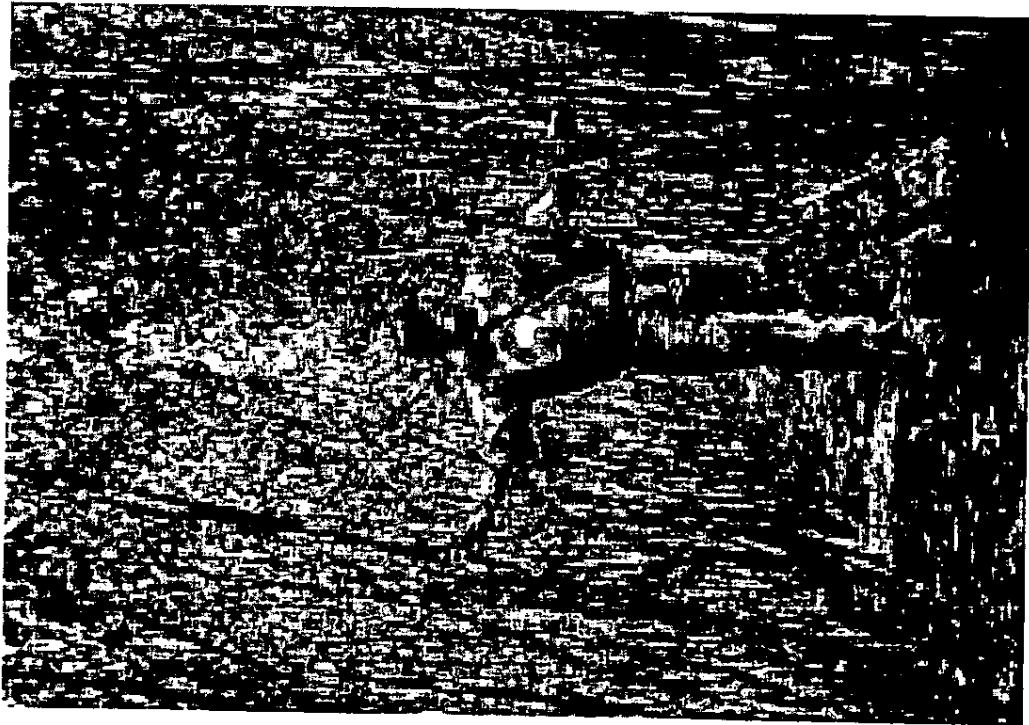
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A National Environmental Program

Sweden's Experience in Willow Farming

- ▶ Started in 1970's
- ▶ Many analogies for Alaska (similar latitude)
- ▶ Controlled pollination, hybridization and cloning all are extensively used
- ▶ Fully mechanized from planting to harvesting
- ▶ Biomass is chipped onsite and stored or directly burned in CHP plants



SUNY's Experience in Willow Farming

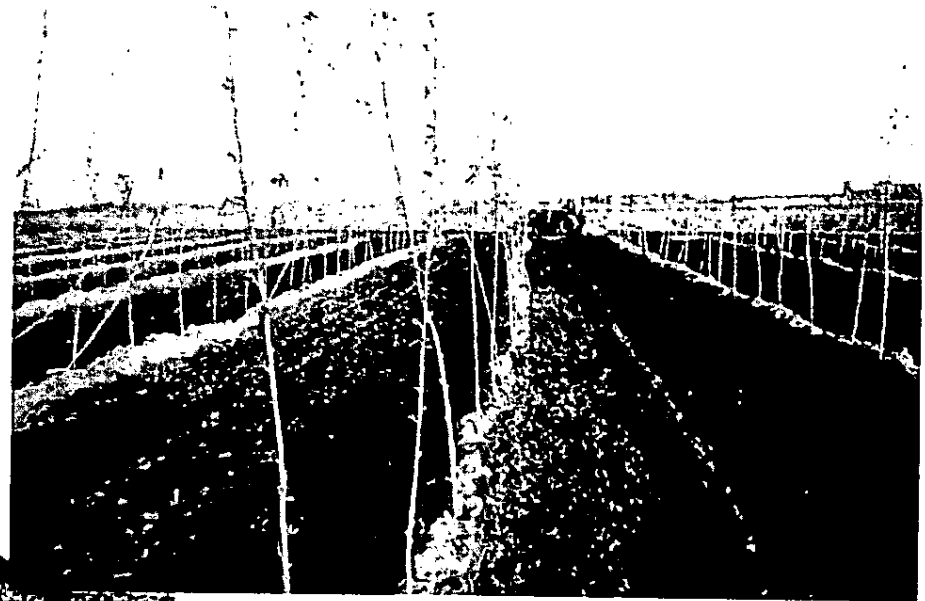


New York University 500 acre willow biomass test plot. Crop is co-fired in nearby coal power plant

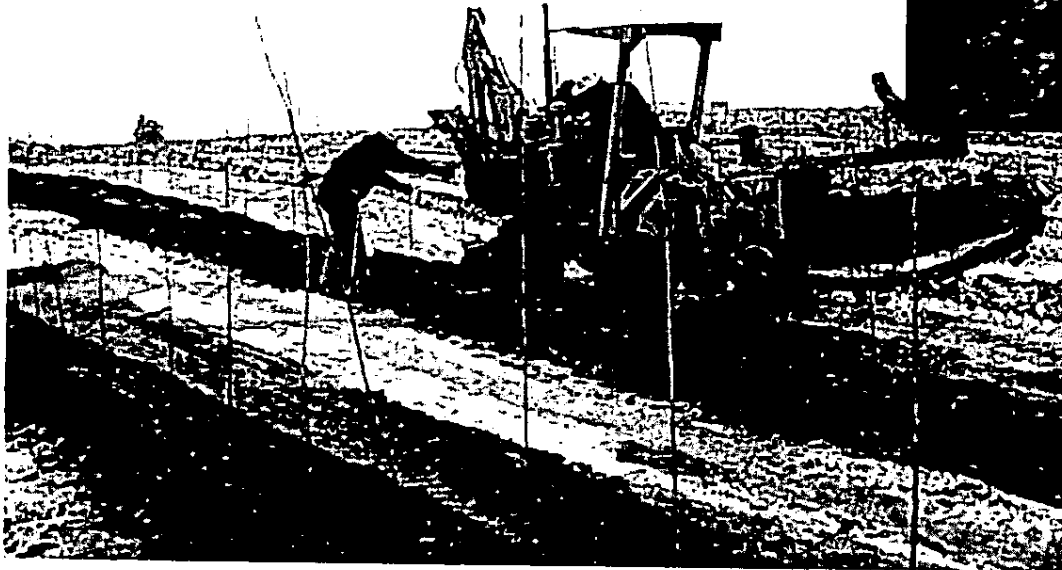


Phytoremediation

Used to treat urban wastewaters, landfill leachate, industrial wastewaters and sewage sludge



Institute of Northern
Engineering



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Advanced Center for Energy and Power

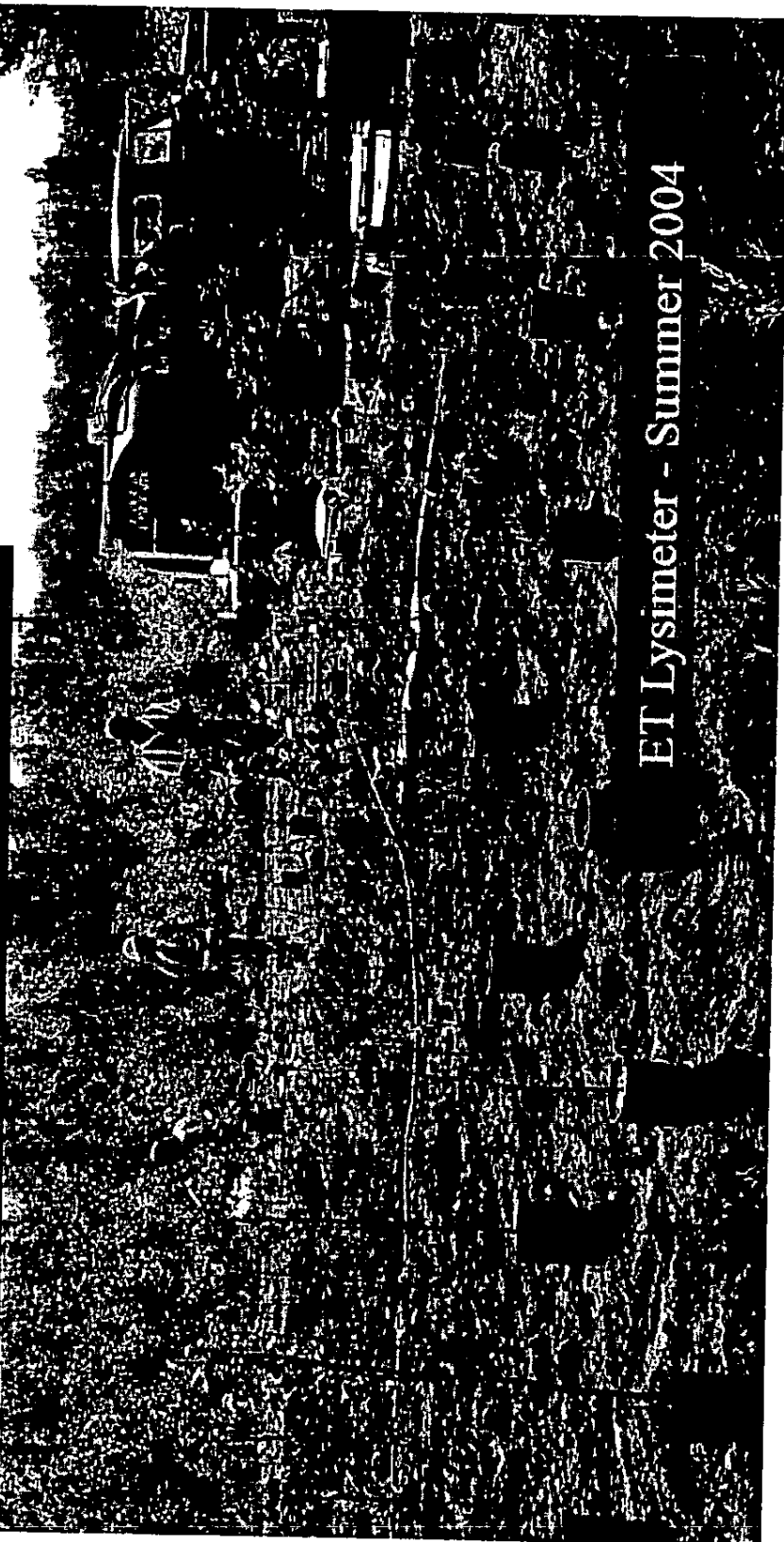
Planting:

Balsam poplar (*Populus balsamifera*)

Black cottonwood (*Populus trichocarpa*)

Quaking aspen (*Populus tremuloides*)

Little leaf / golden willow (*Salix alba*)



ET Lysimeter - Summer 2004



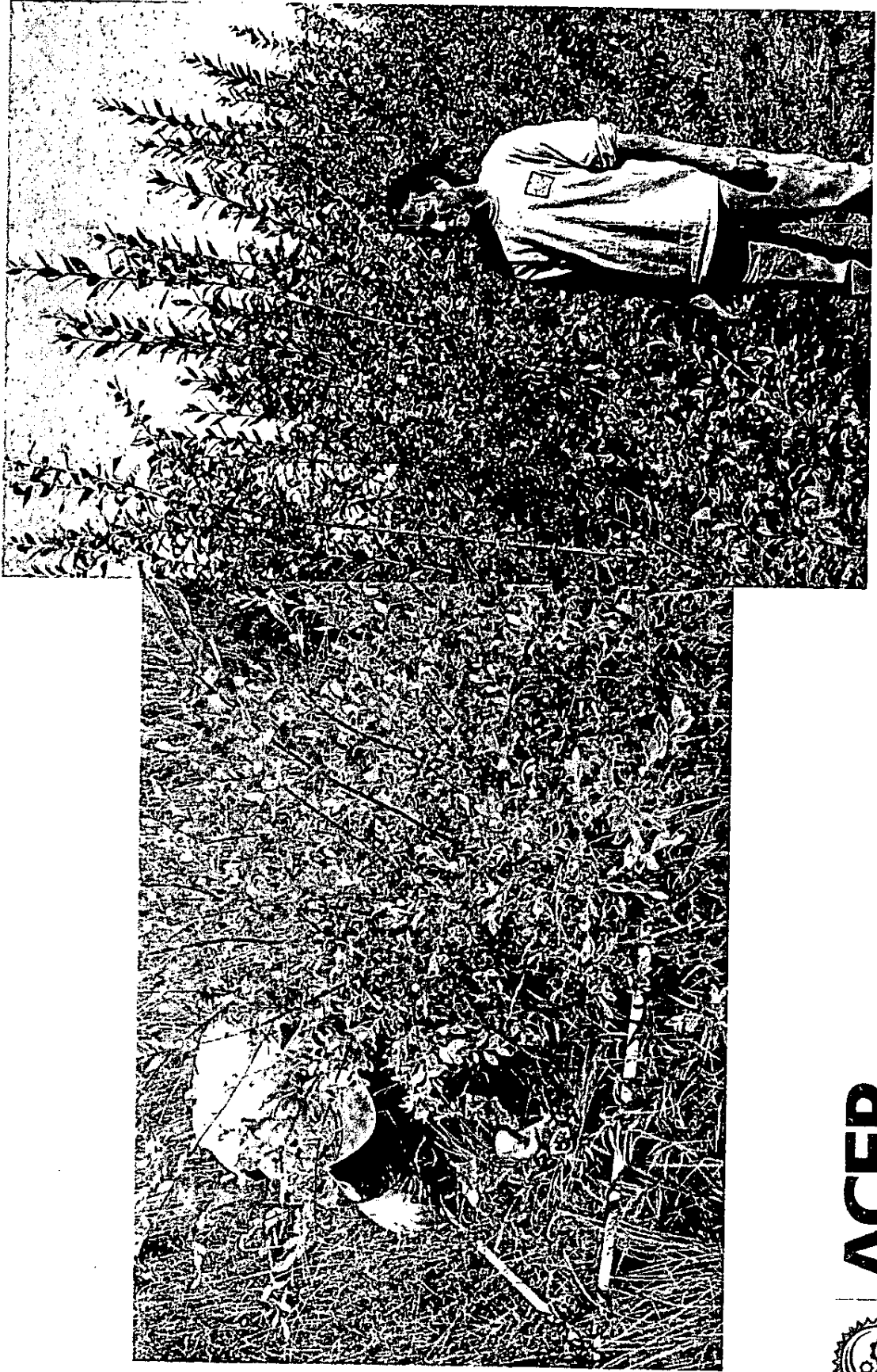
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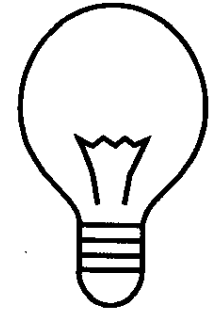
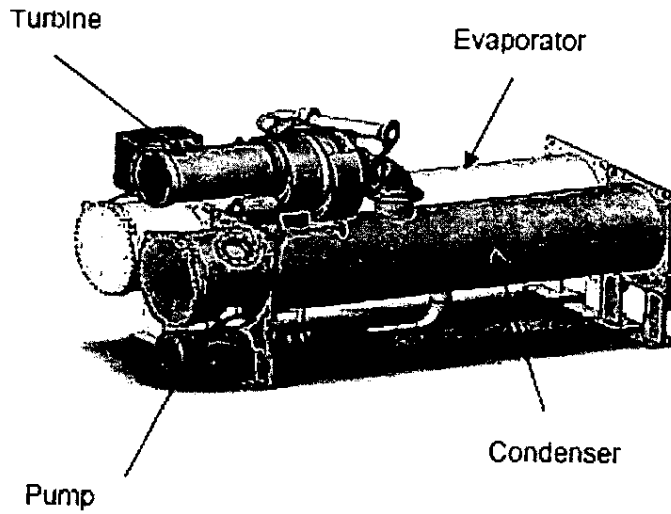
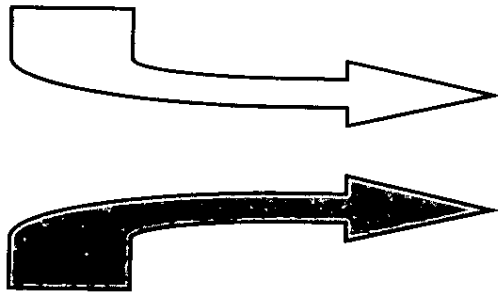
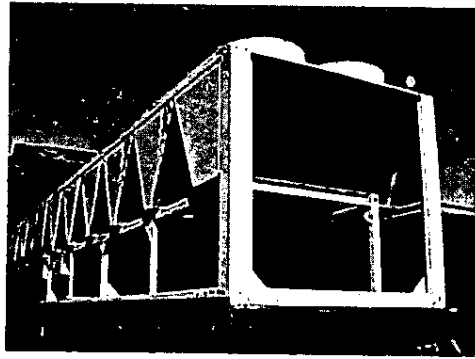
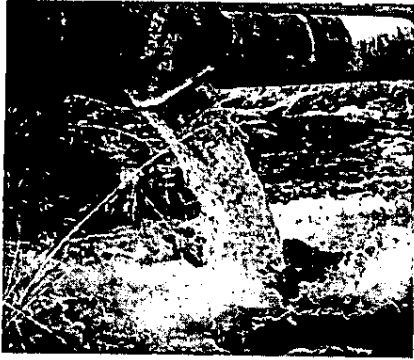
Fast growing grasses



School of Natural Resources and
Agricultural Sciences

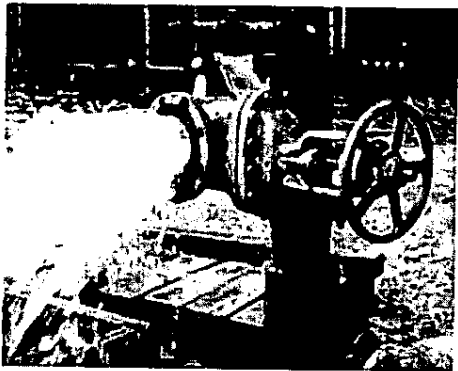
Woody Biomass





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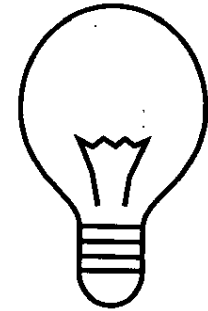
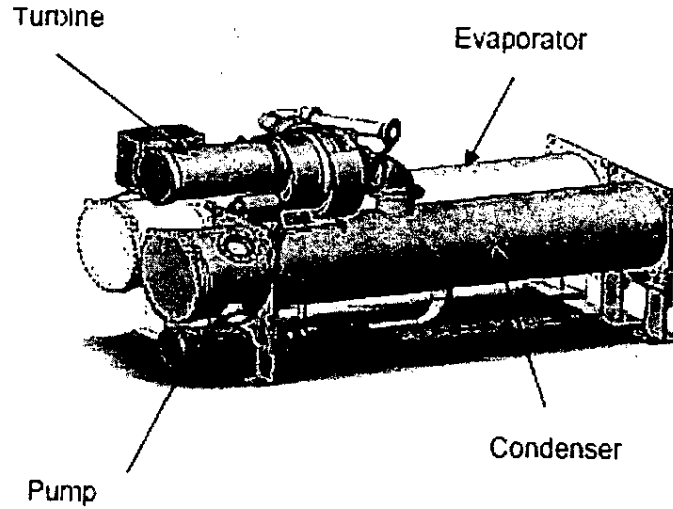
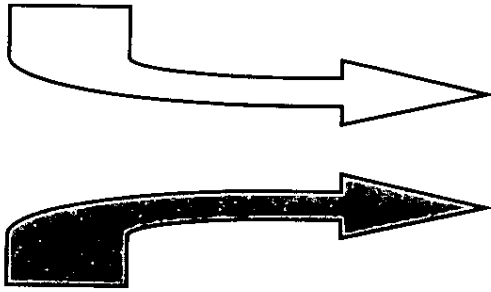
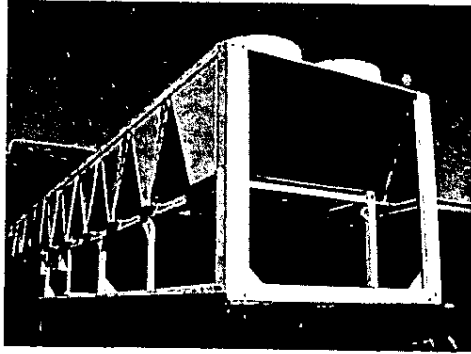
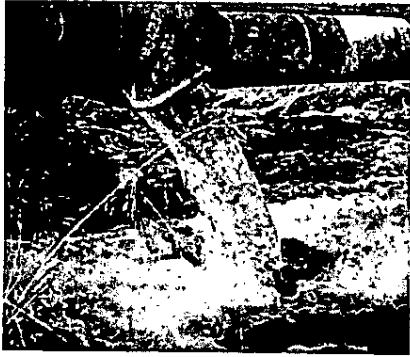
Heat



Chena Geothermal Powerplant
Organic Rankine Cycle (ORC) technology



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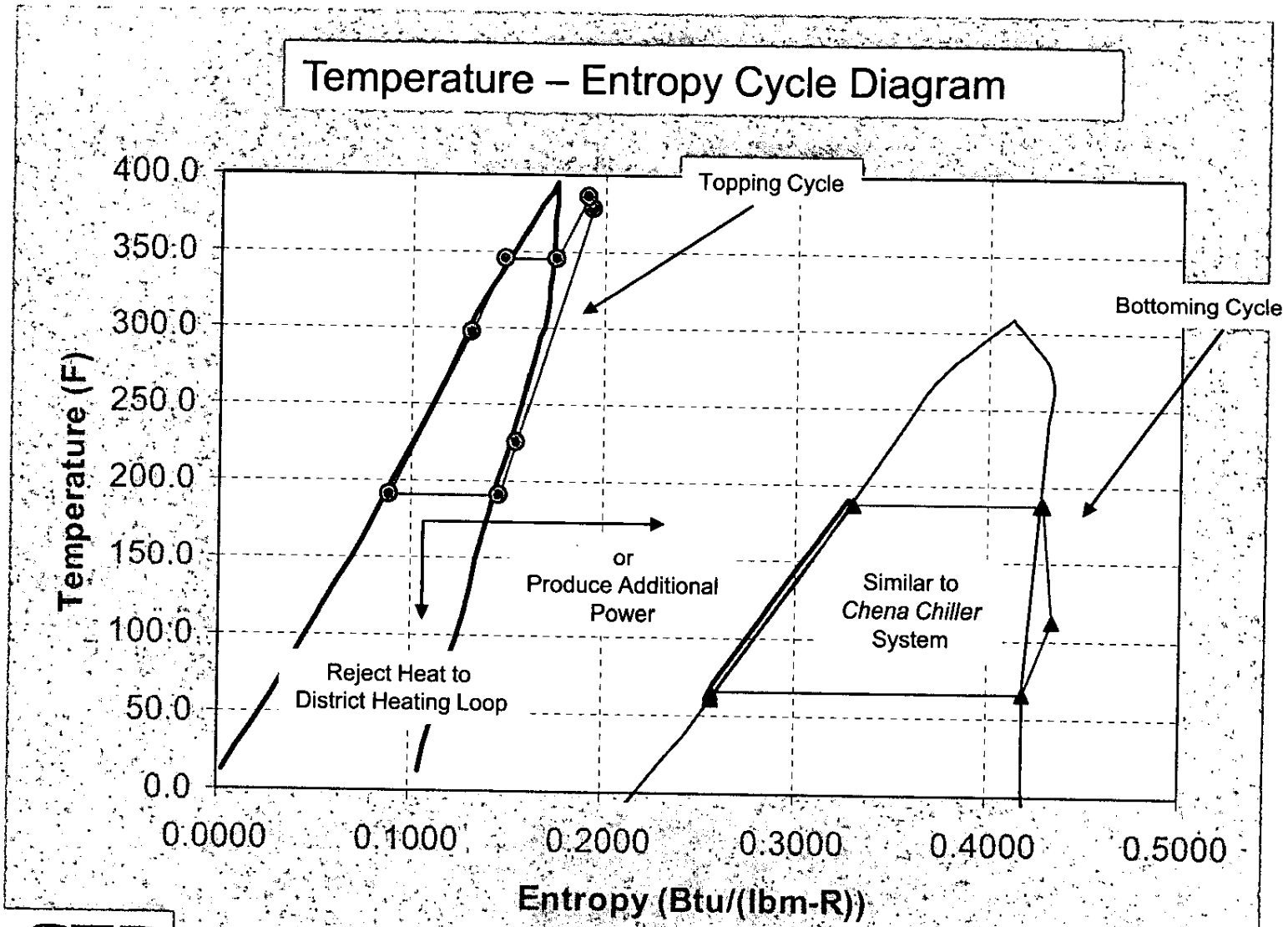
Heat

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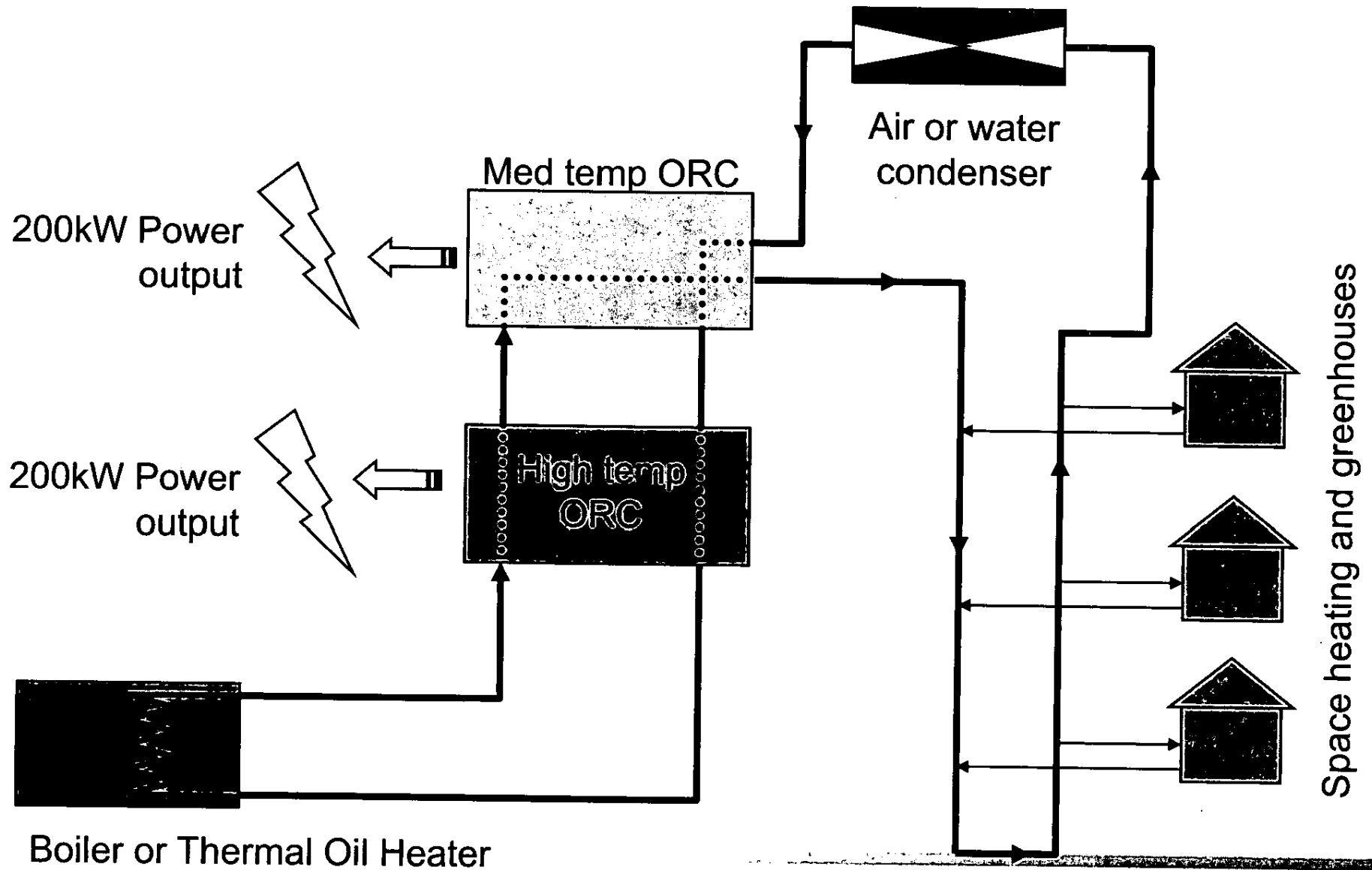


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Asian Center for Energy and Power

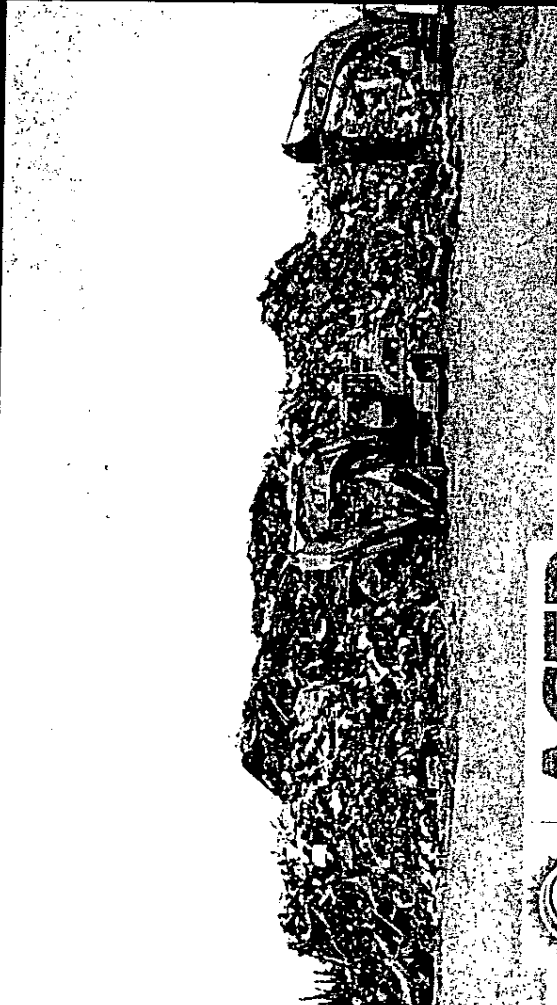
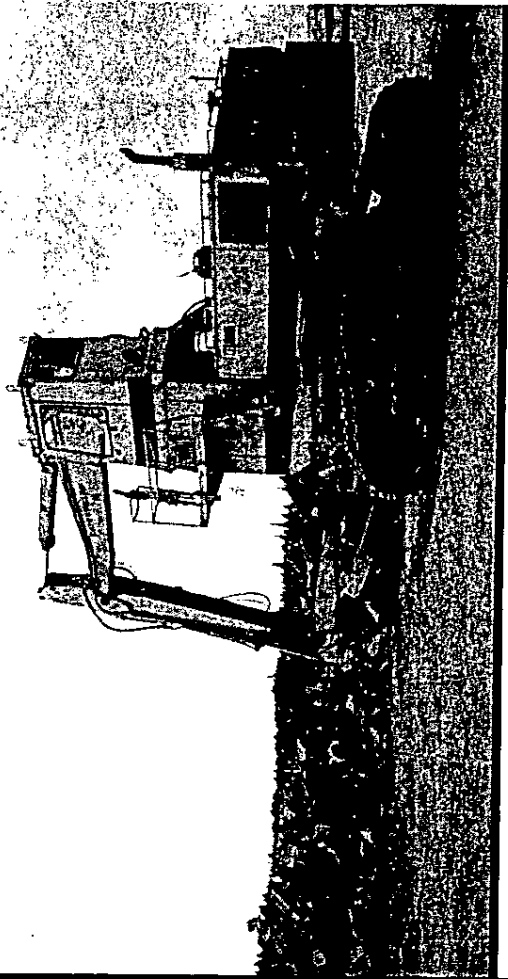
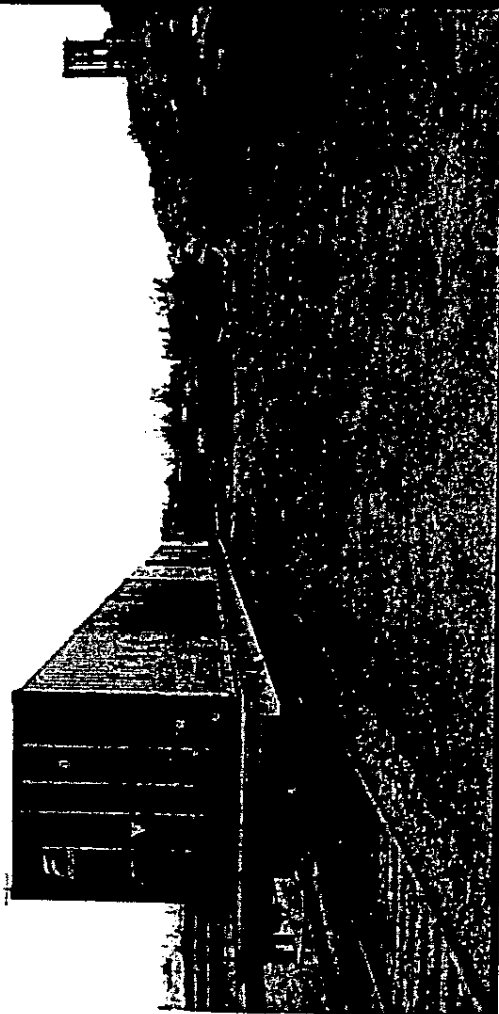
Topping cycle doubles efficiency to >20% and increases energy utilization to 80%



The Goal: Combined Heat and Power (CHP)



Demonstration Project at K&K Recycling



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Demonstration Project at K&K Recycling

- Located near North Pole
- 400kW gross, 300kW net output
- Fuel is 5000 tons of paper, cardboard and brush supplemented with farmed willow (future)
- Designed for rural village application – thermal oil boiler, load following
- Estimated cost to generate power is 6.4¢ per kWhr
- Co-located with heat load (space heating, greenhouses)



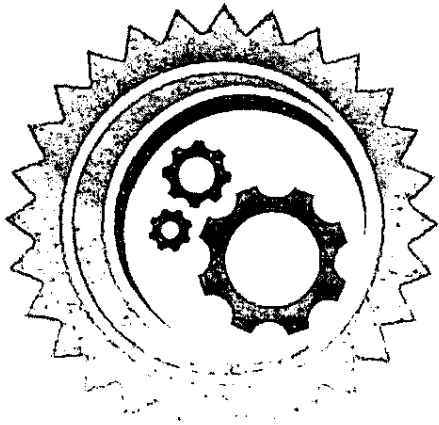
www.uaf.edu/acep

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ACEP RESEARCH MISSION: To meet state and local need for applied energy research by working towards developing, refining, demonstrating, and ultimately helping commercialize marketable technologies that provide practical solutions to real-world problems.



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Biomass Energy in Alaska: Overview of Programs and Projects

Senate Special Committee on Energy

February 5, 2009

Juneau

Peter Crimp
ALASKA
ENERGY AUTHORITY



Alaska Energy Authority

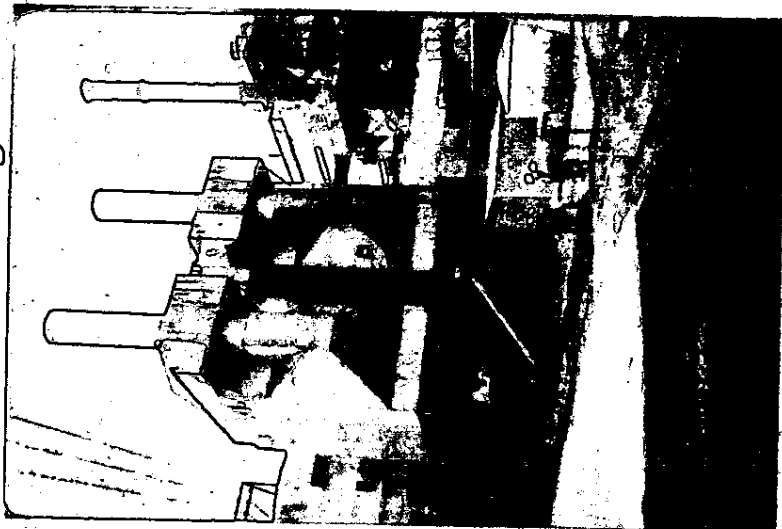
- ┌ Public corporation with Alaska Industrial Development and Export Authority
- ┌ Infrastructure Owner: Anchorage-Fairbanks Intertie, Bradley Lake Hydro, Healy Clean Coal Plant
- ┌ Rural Energy Group: Tank farm and power system construction
- ┌ Alternative energy

Wood—the old standby

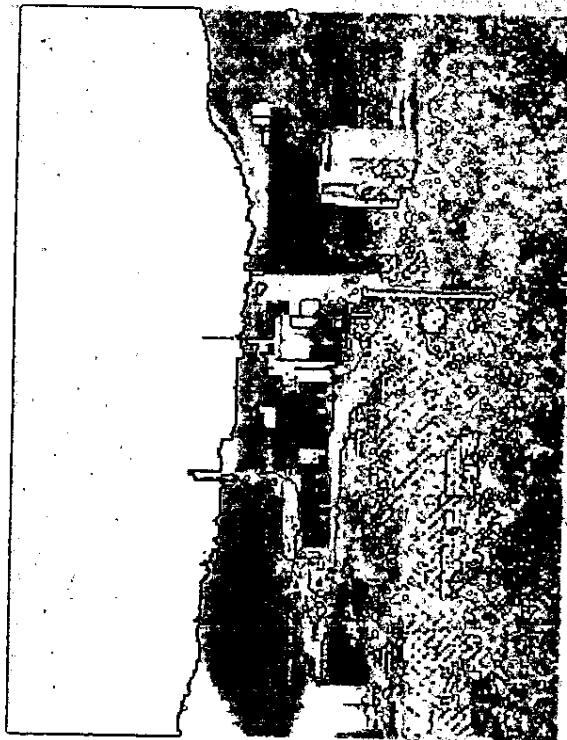


Photo : UAF Archives

Northern Commercial, Fairbanks



Alaska Pulp Co., Sitka 25 MW

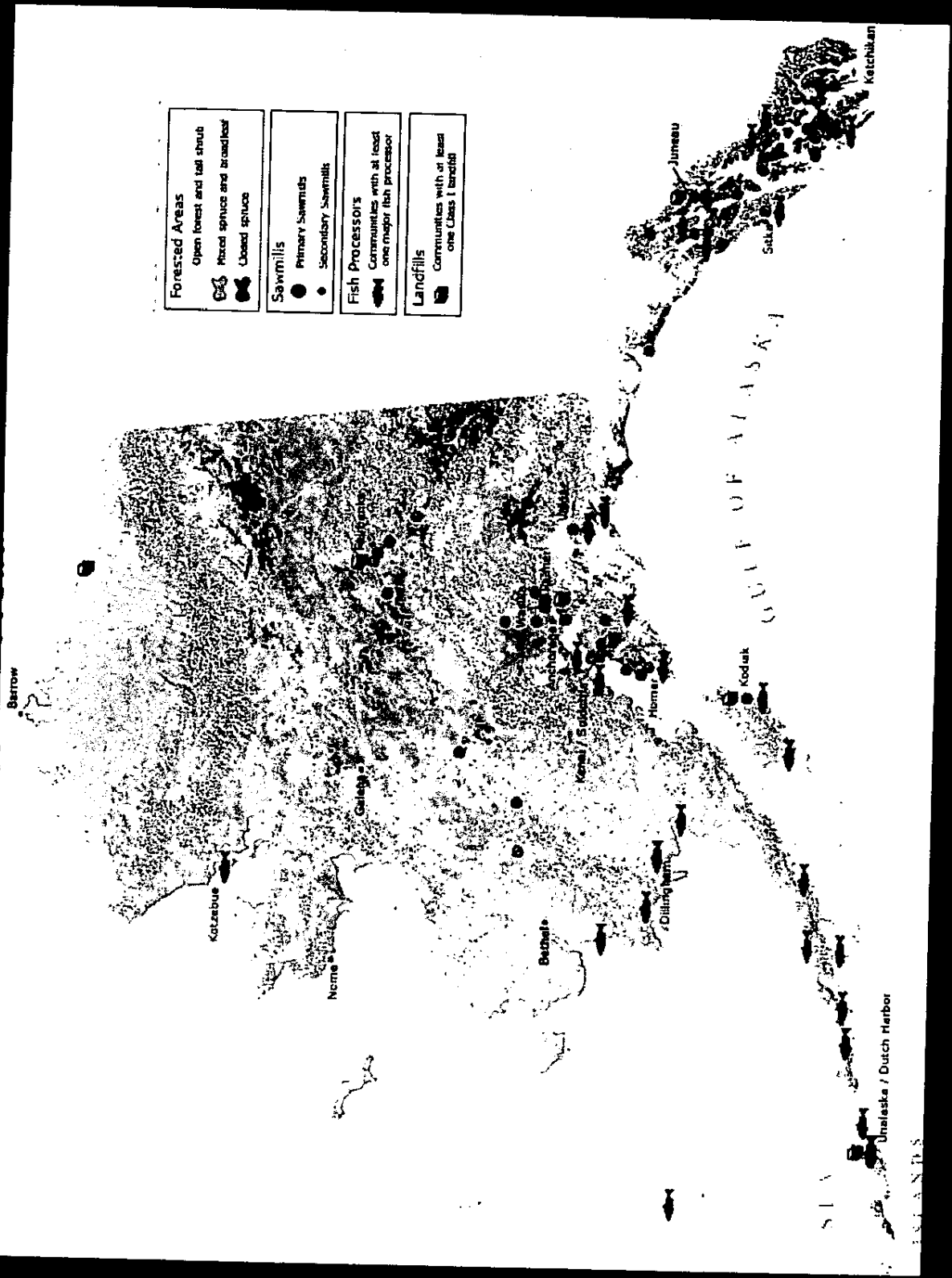


Ketchikan Pulp Co., 38 MW

What I'll Talk About

- Supply of resource vs demand
- Energy conversion options in Alaska—
focus on community systems
- Economic considerations
- Current projects in development

Alaska Biomass Energy Resources

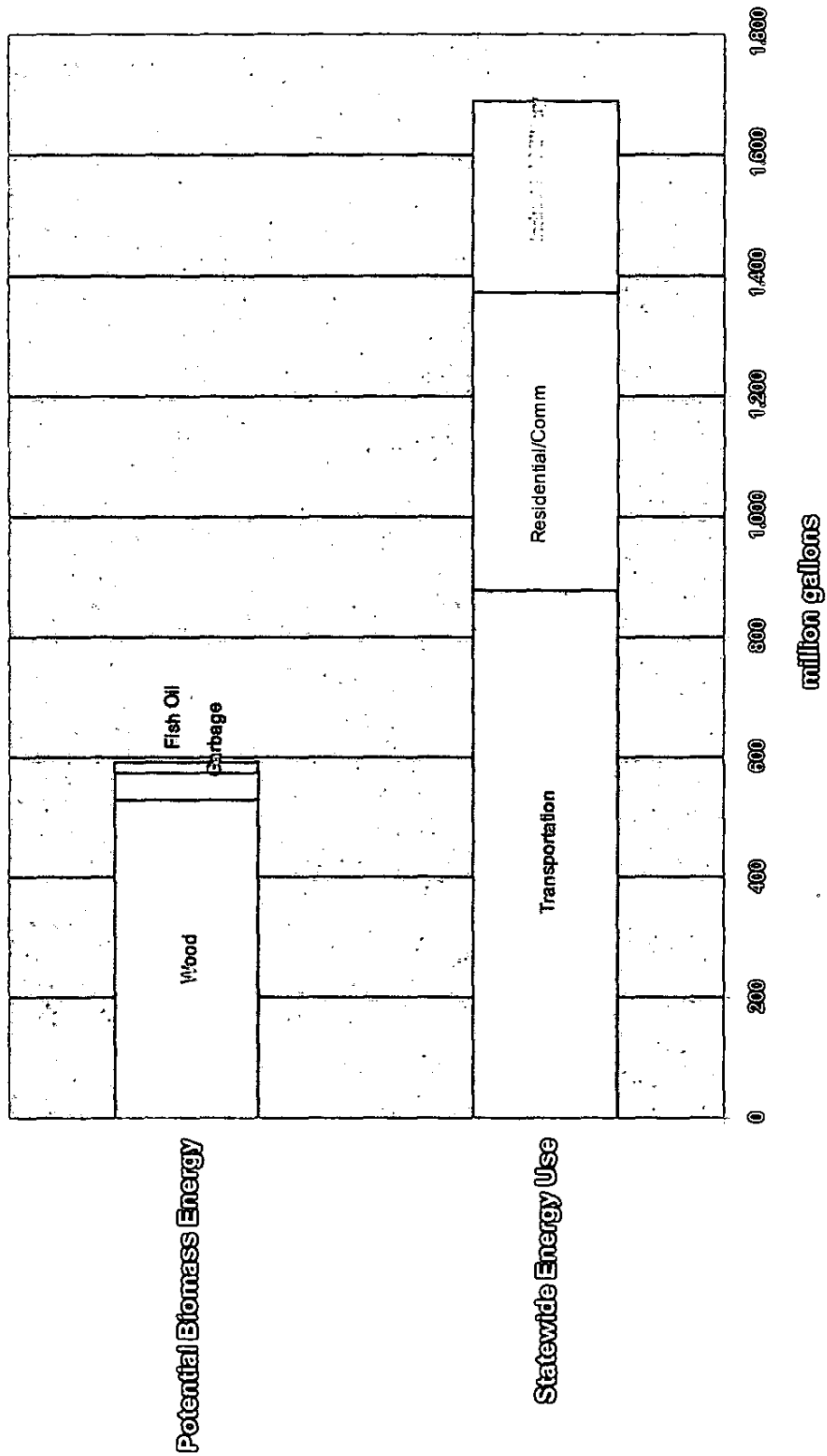


Wood Biomass

- └ 100,000 cords used for heating annually
- └ Alaska has enormous wood resources
 - └ 18,500 sq miles of available, productive forest
 - └ Can grow 3.5 million cords of wood per year
- └ Forest Benefits
 - └ Forest fuels removal to reduce wildfire risk
 - └ Use trees killed by spruce bark beetle
 - └ Wildlife habitat enhancement

Potential Biomass Energy vs Actual Alaska Energy Use

(in diesel gallon equivalents)



Wood Energy Technologies

- ┆ Residential wood heating
- ┆ Stick-fired with thermal storage
- ┆ Pelletized wood fuel
- ┆ Chip/residuals boilers and heaters
- ┆ Gasification & pyrolysis
 - ┆ Producer gas
 - ┆ Liquid fuels

Considerations

- ┆ Air pollution
- ┆ Fuel supply—depletion, aesthetics, conflicts
- ┆ System reliability and complexity
- ┆ Economic feasibility
 - ┆ Heat and power buyers
 - ┆ Other alternatives

Burning wood wrong



Burning Wood Right

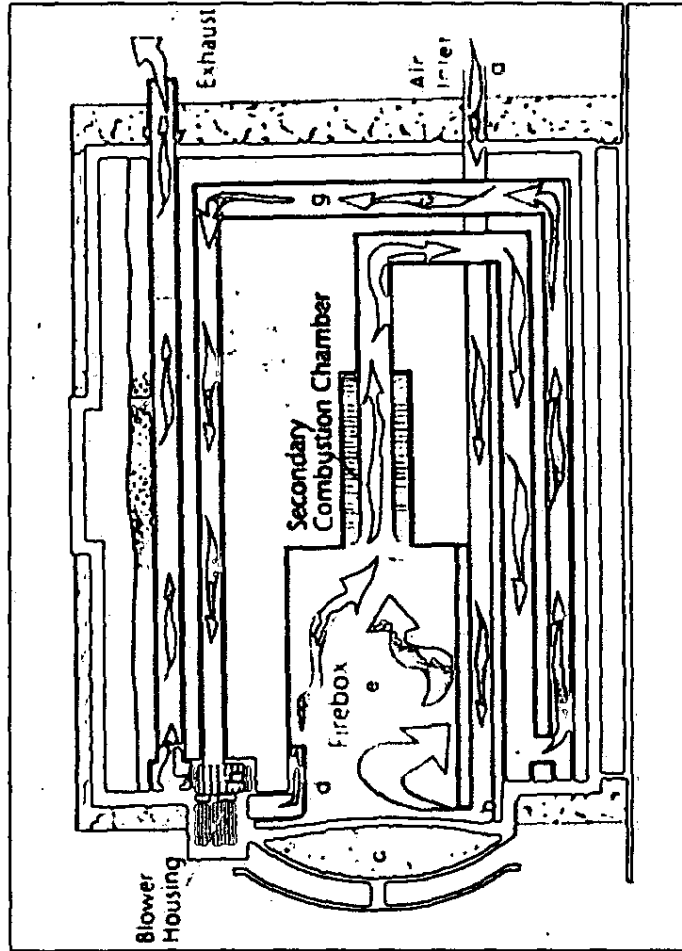
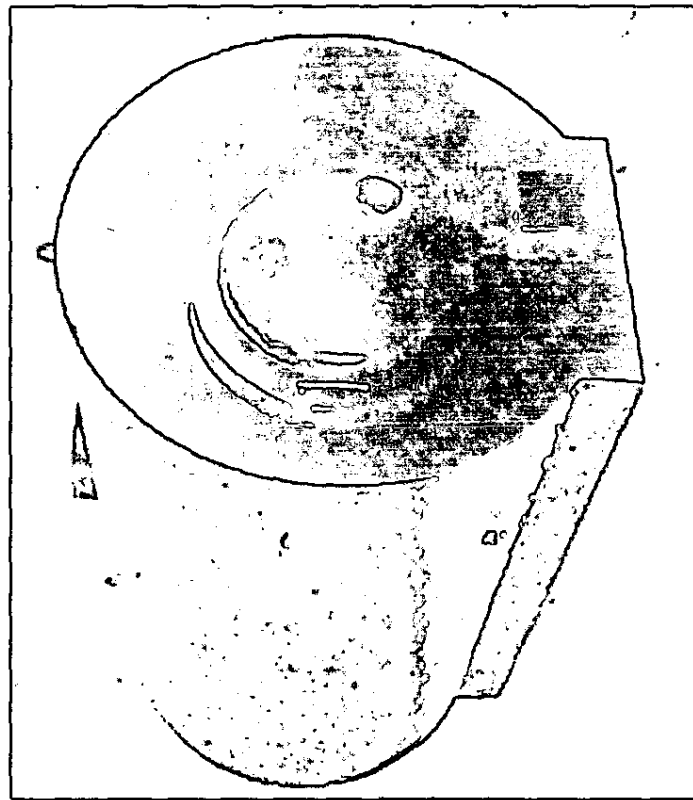


Wood-Fired Facility Heating

Economically feasible when

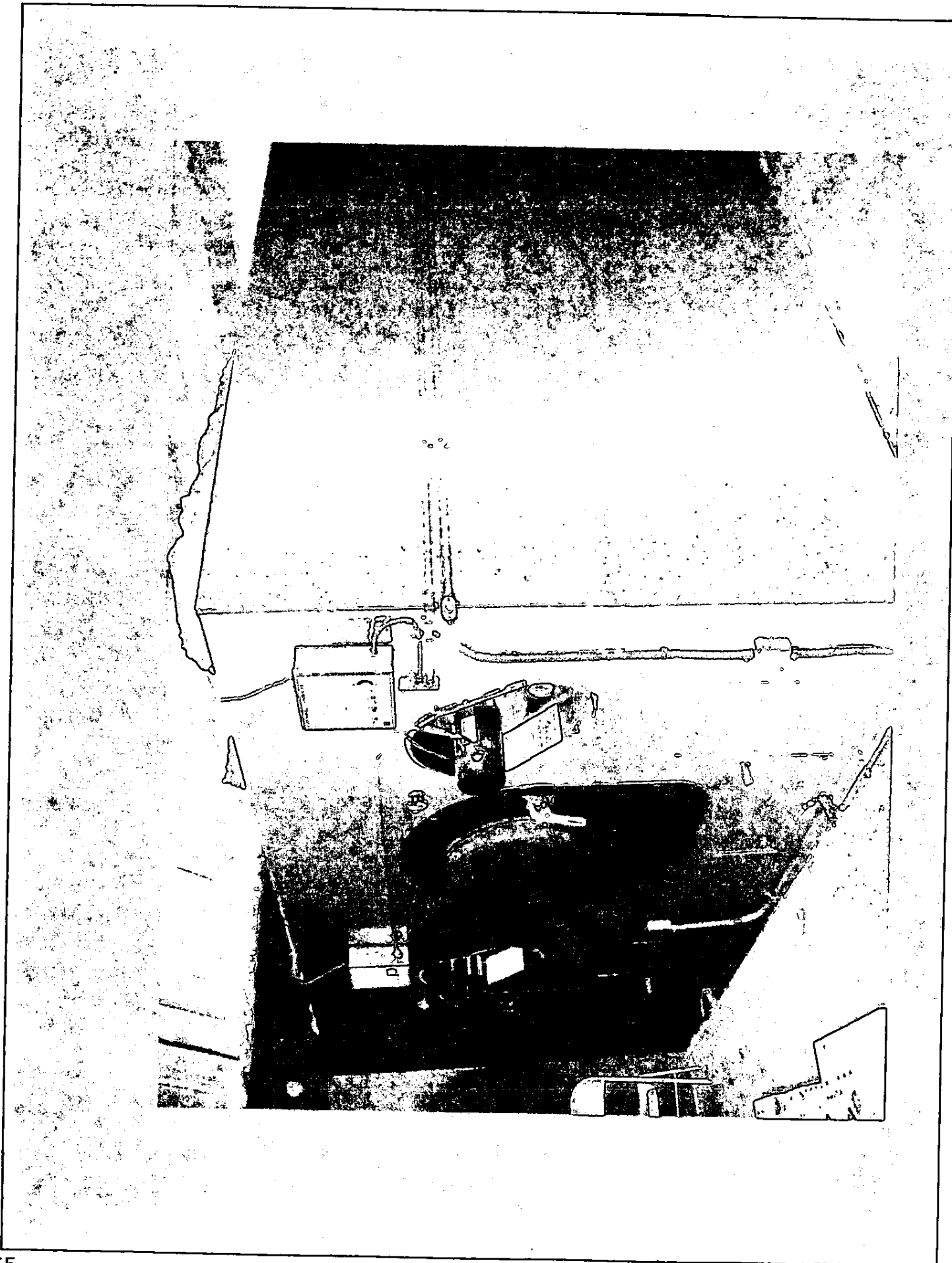
- ┌ Low to moderately priced fuel available
- ┌ Oil, propane, or electric energy displaced

Cordwood Boiler System (Garn—Dectra Corp)



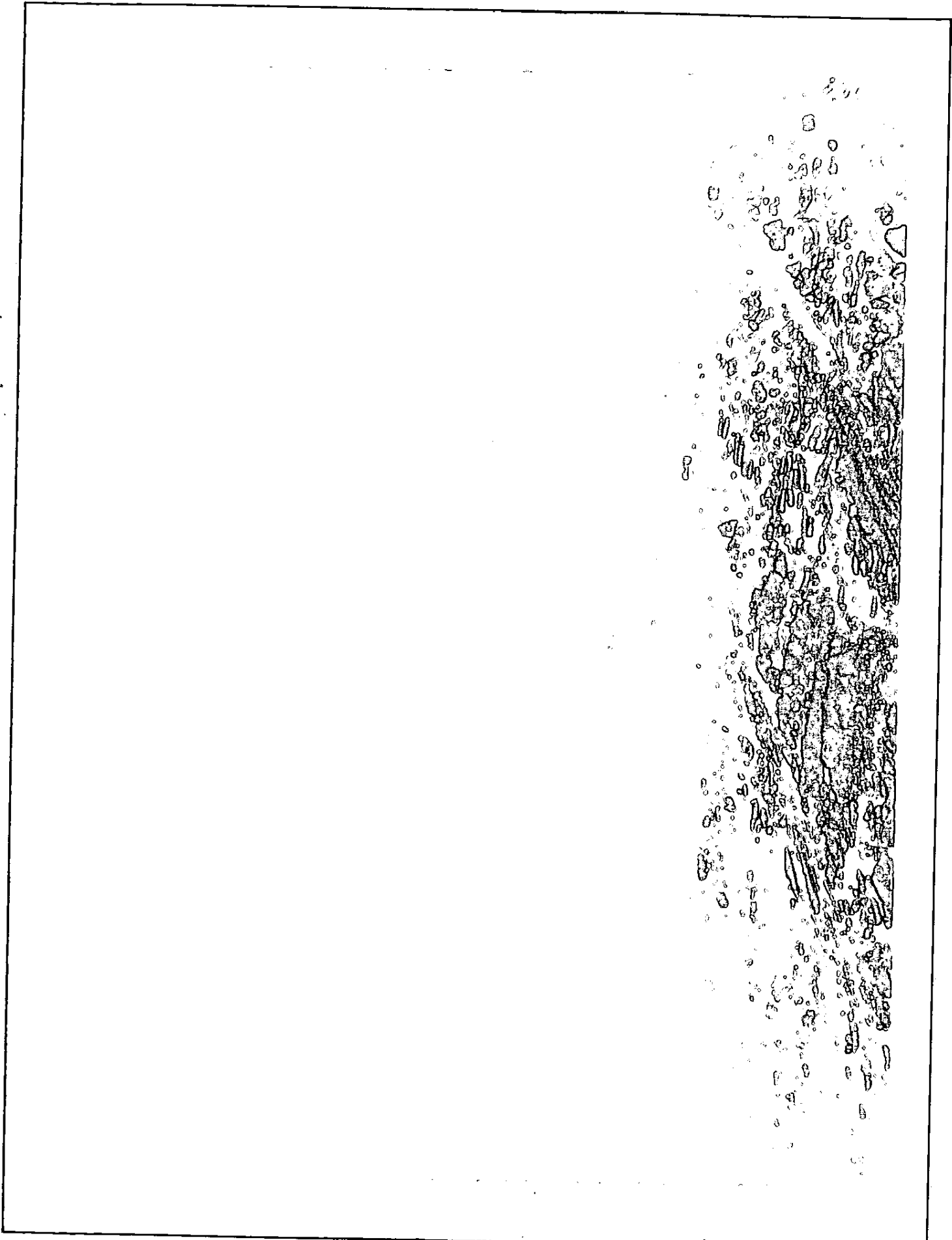
Tanana Installation (Fall 07)



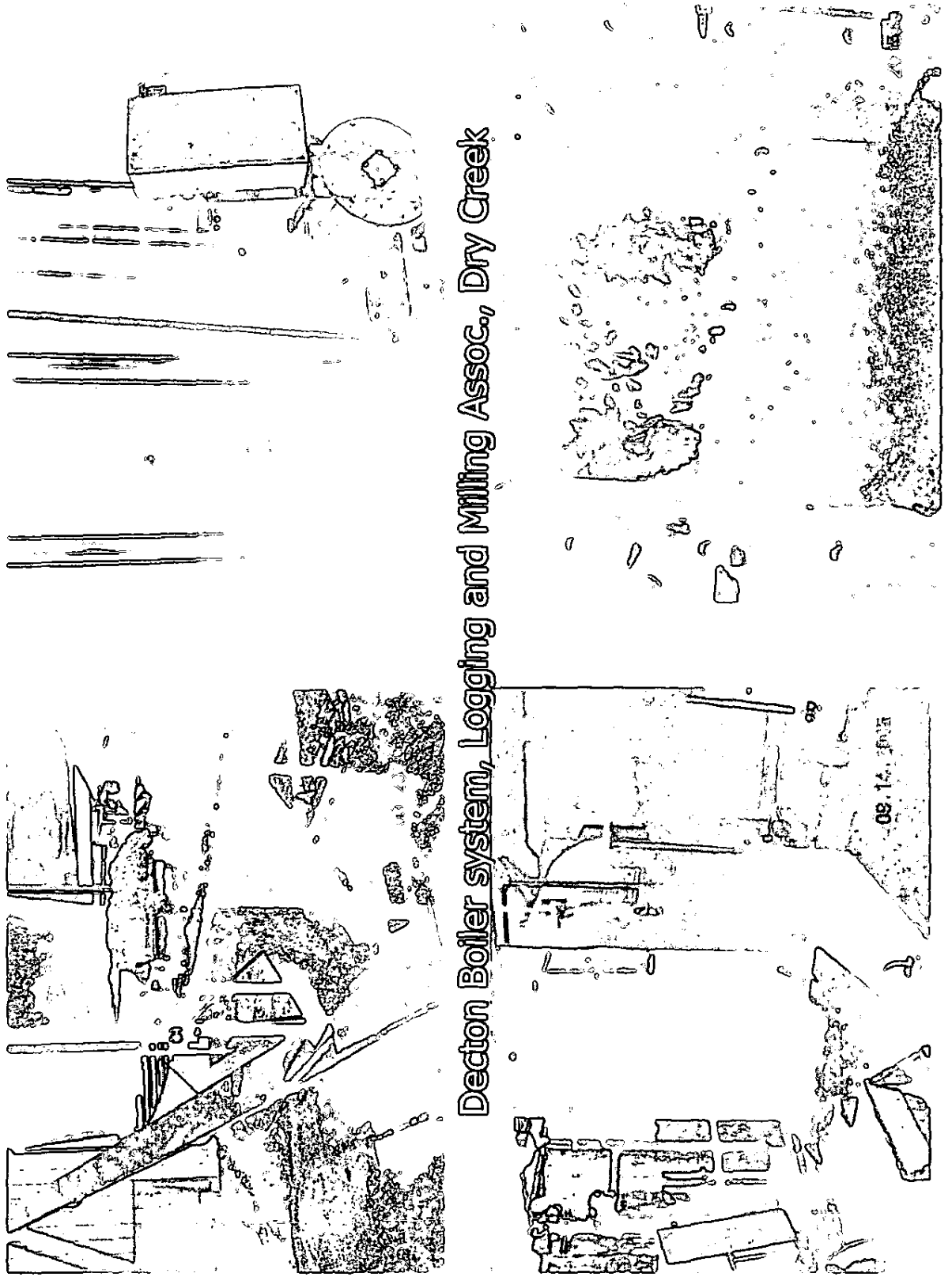


Dot Lake System Operation



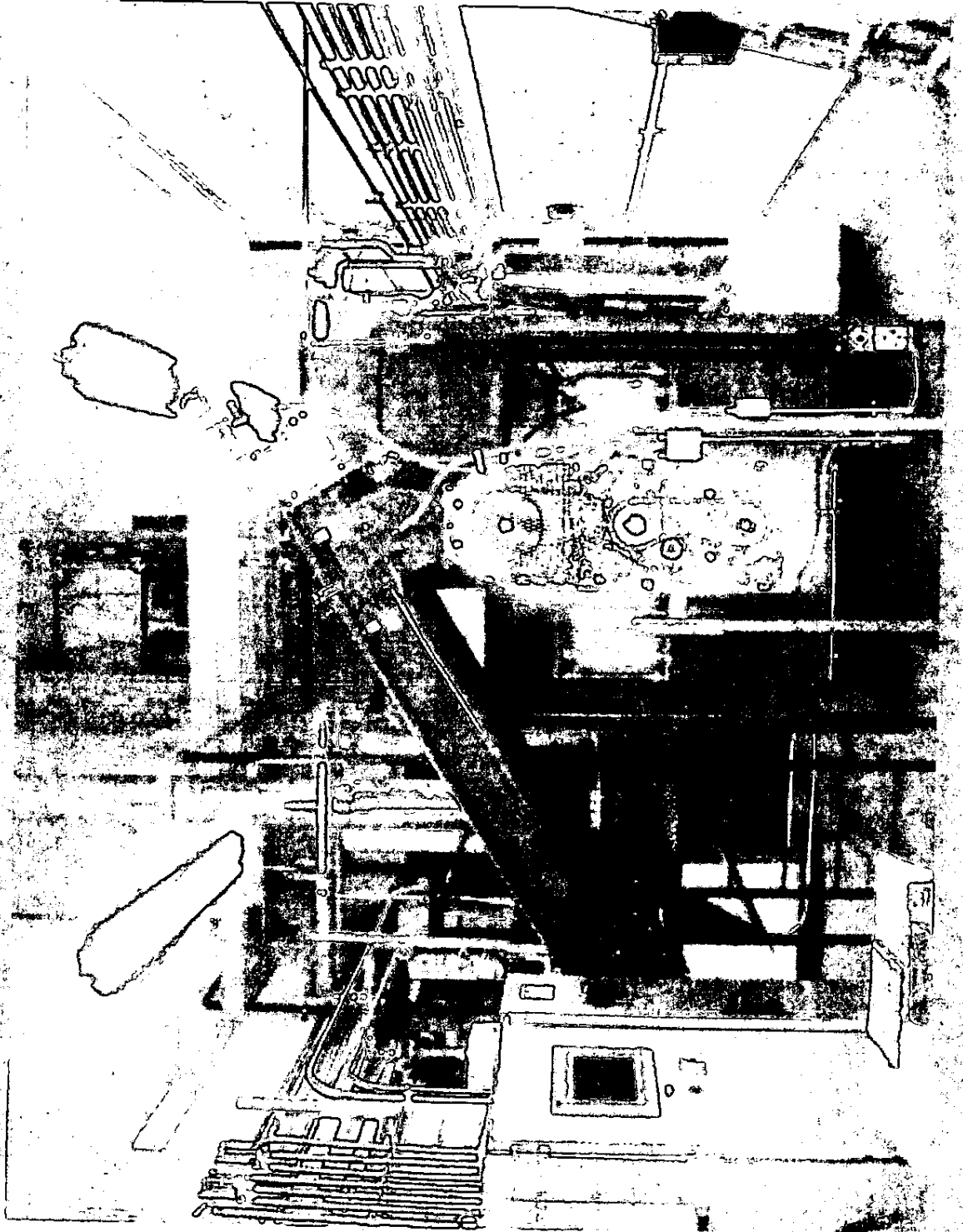


Chip-fired Facility Heating



Decton Boiler system, Logging and Milling Assoc., Dry Creek

Craig Community Heating System



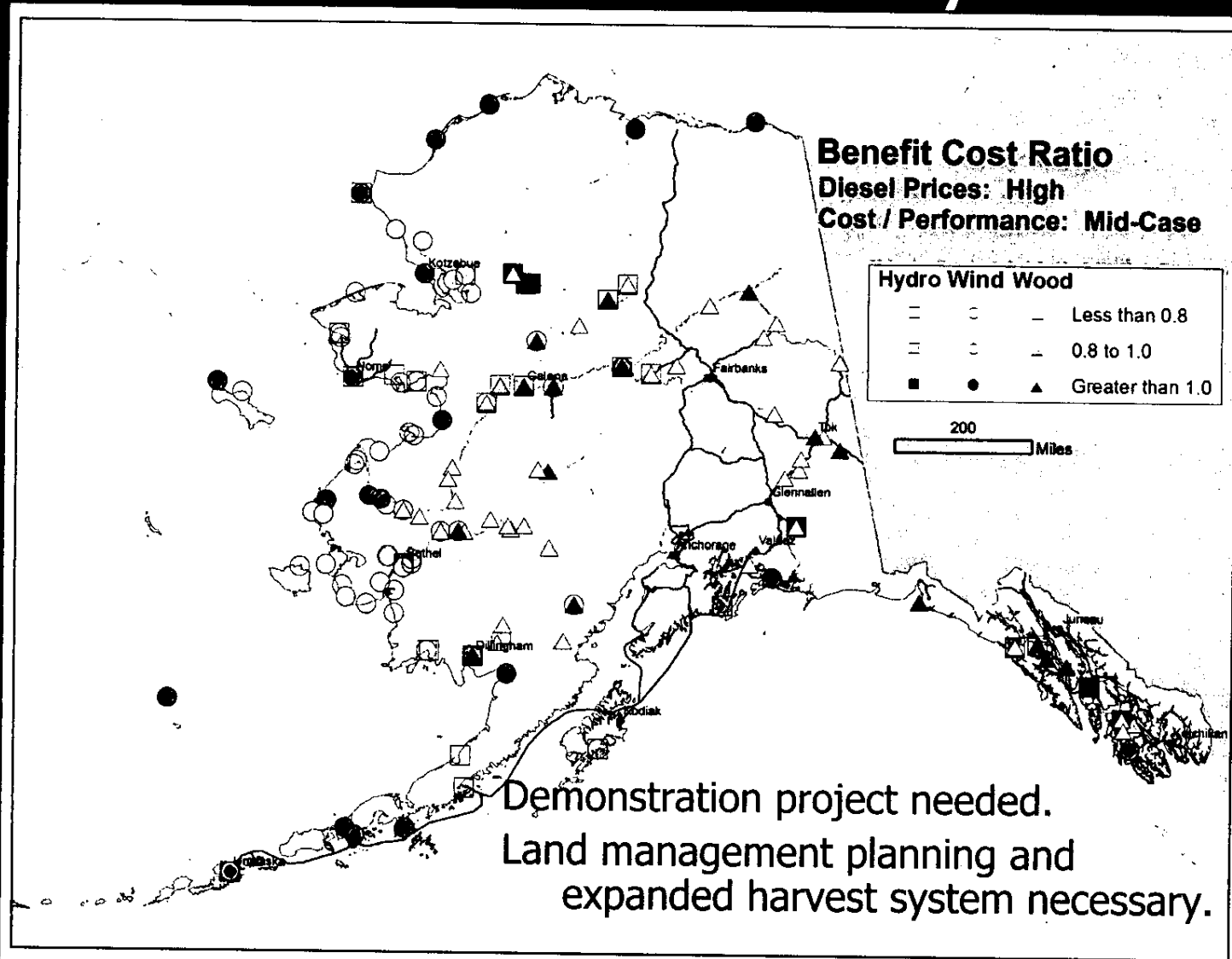
Wood-Fired Power

Currently economic when

- ┌ Plentiful-low cost fuel available
- ┌ Diesel power is displaced
- ┌ Large market for both power and heat

Few commercialized small systems suitable for village power.

Economics of Village Scale Wood-fired Power Systems



CPC BioMax 50 kW Unit

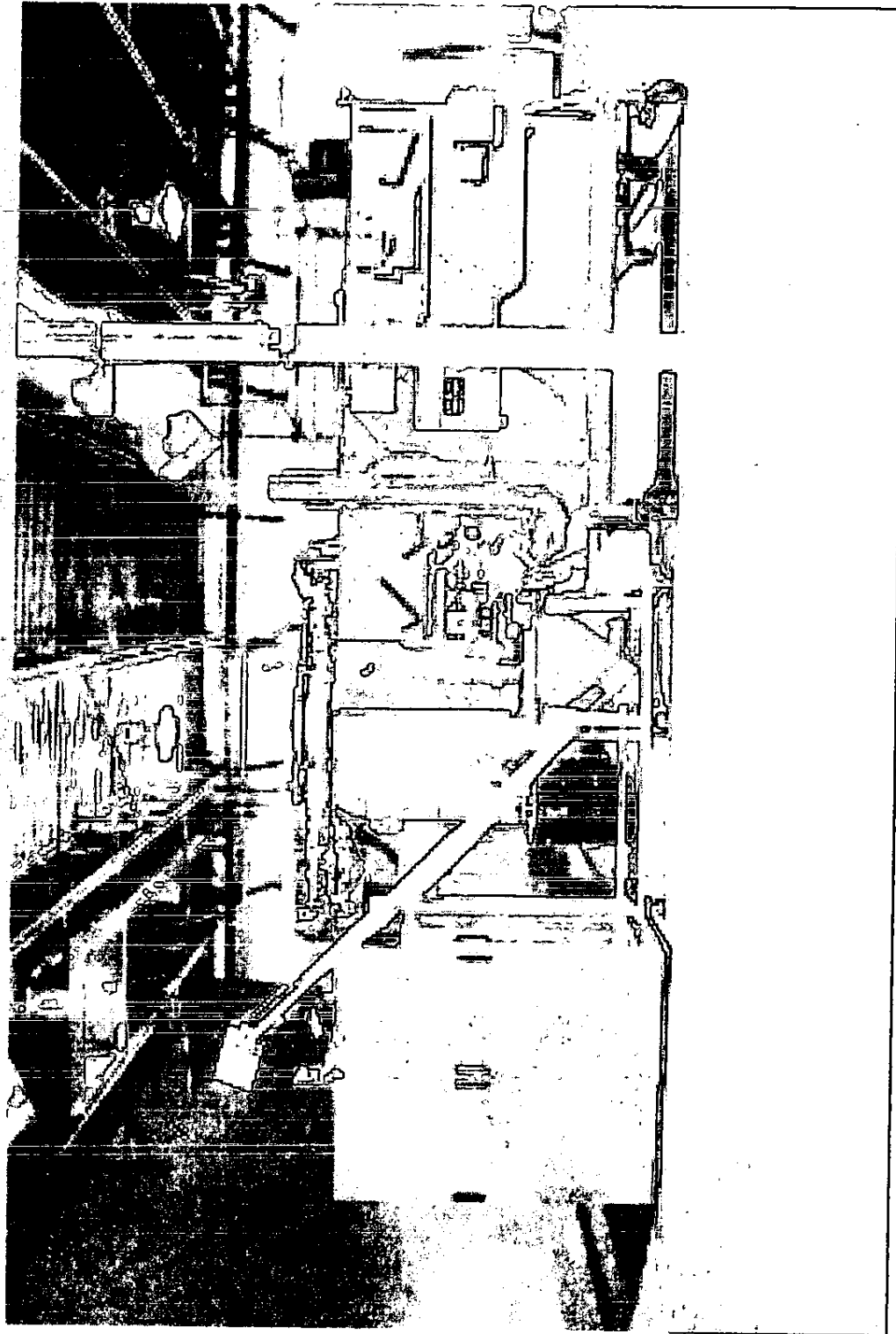
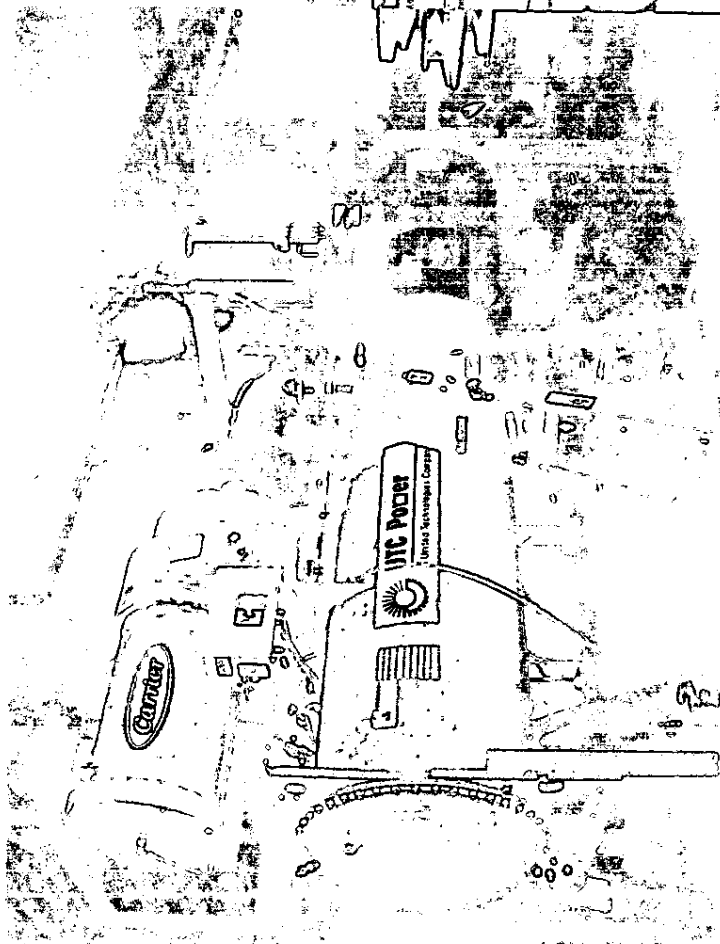


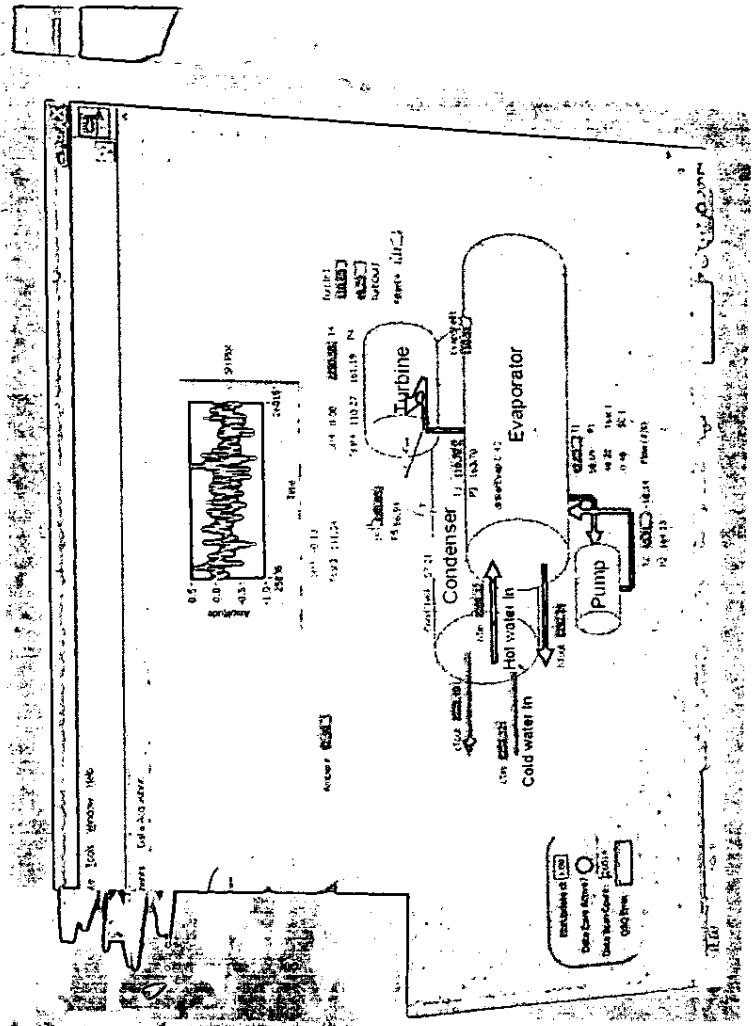
Photo: Community Power Corp.

Planned Organic Rankine Cycle

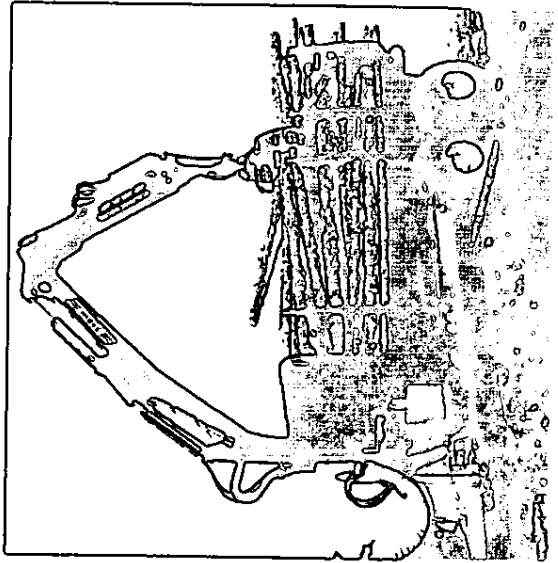
North Pole



Chena Hot Springs
(2 x 200 kW)

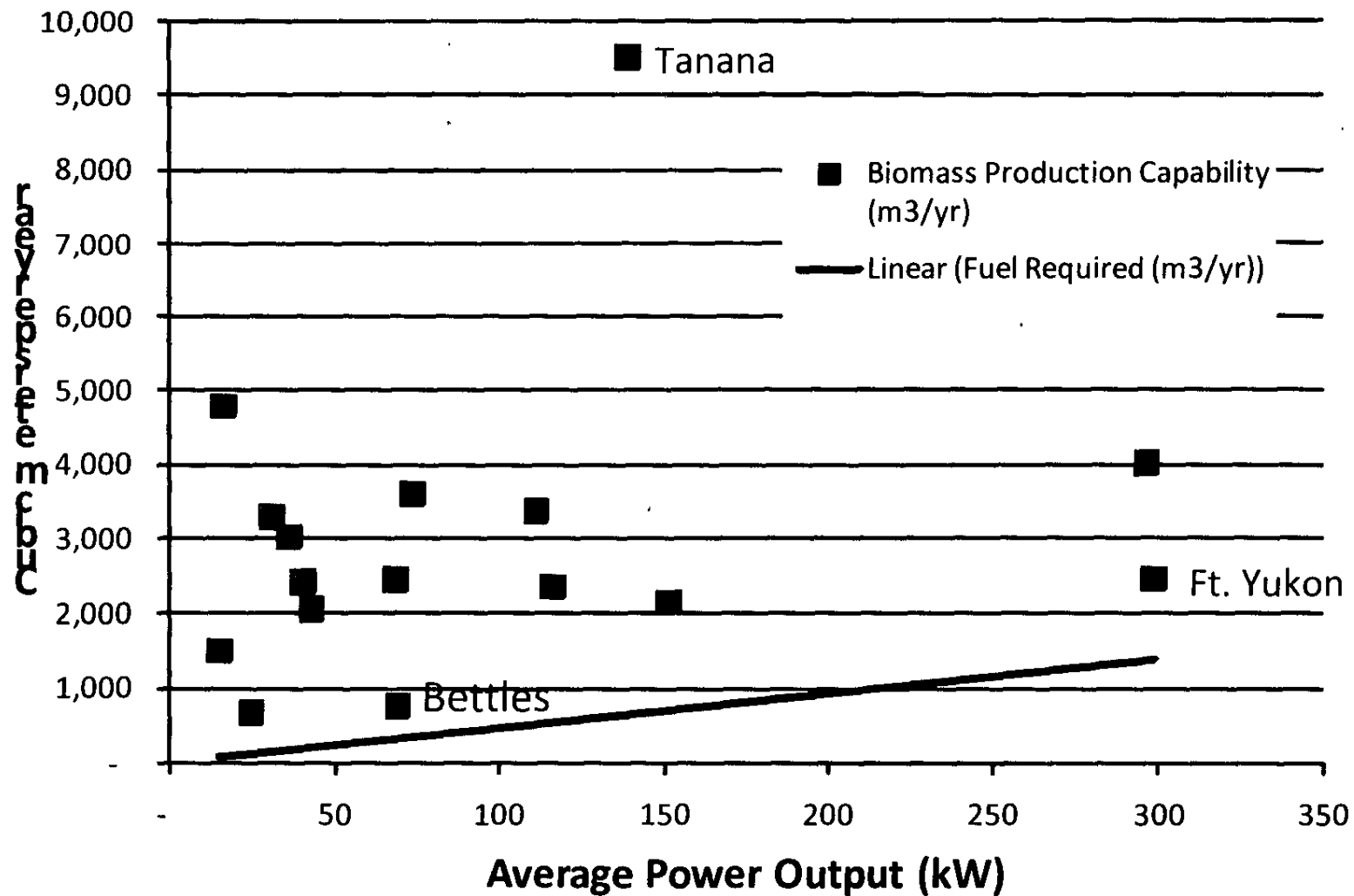


AVI Proposed Rural Wood Fuel Supply System



- Establish regional subsidiary
- Harvest on village lands according to locally developed management plans
- Provide to tribes for local sales for heating and power
- Capital costs for system capable of producing 7,000 TPY: \$580,000

Biomass Supply vs Requirement Interior Alaska Communities

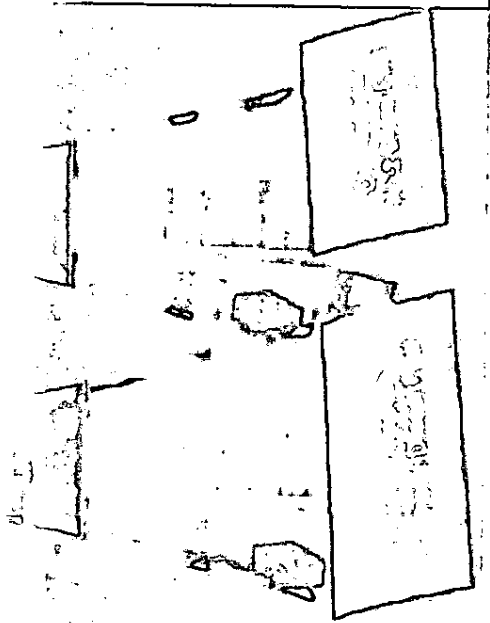
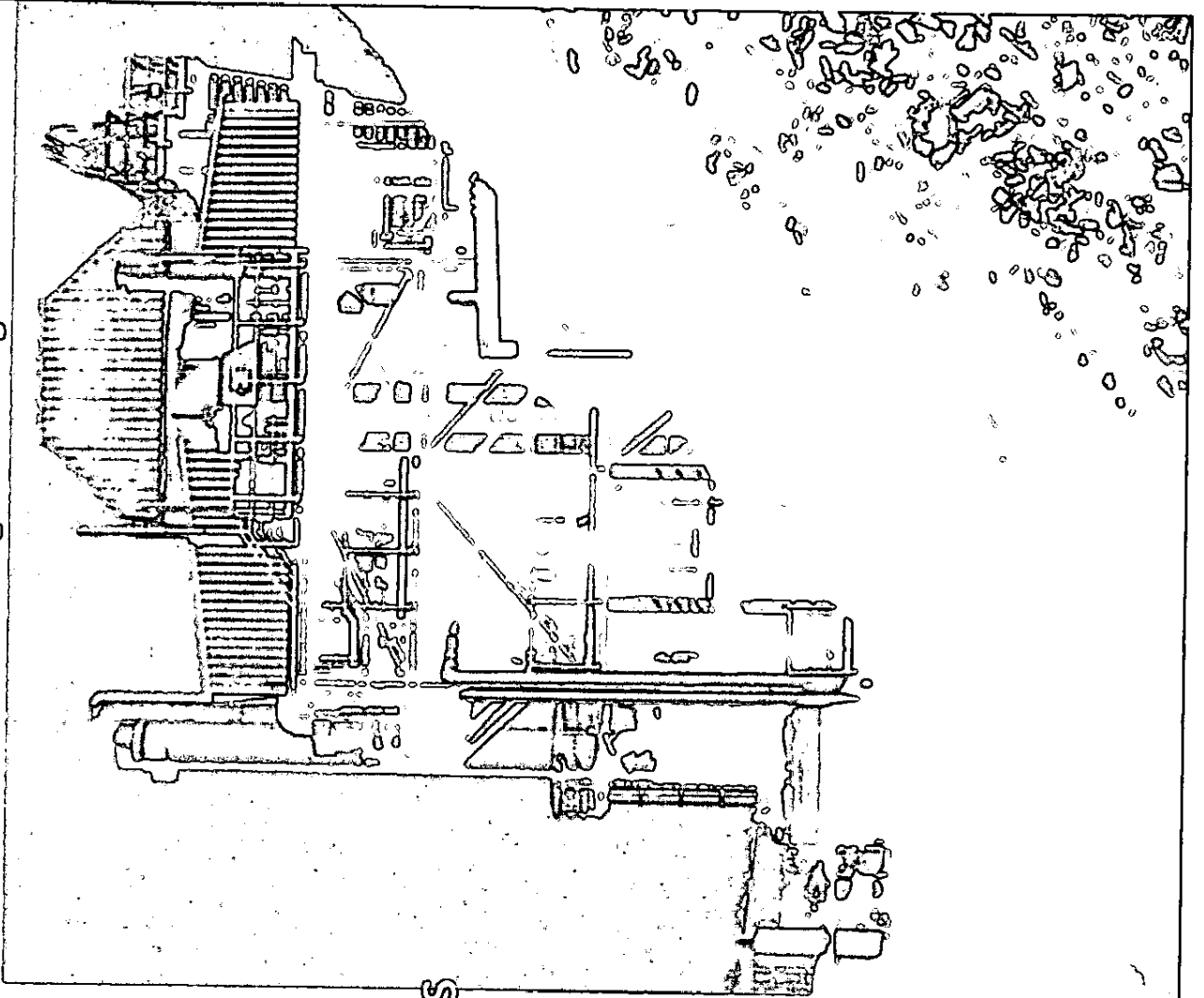


Timber inventory source: Putman 2007

Biomass to Liquids (BTL)

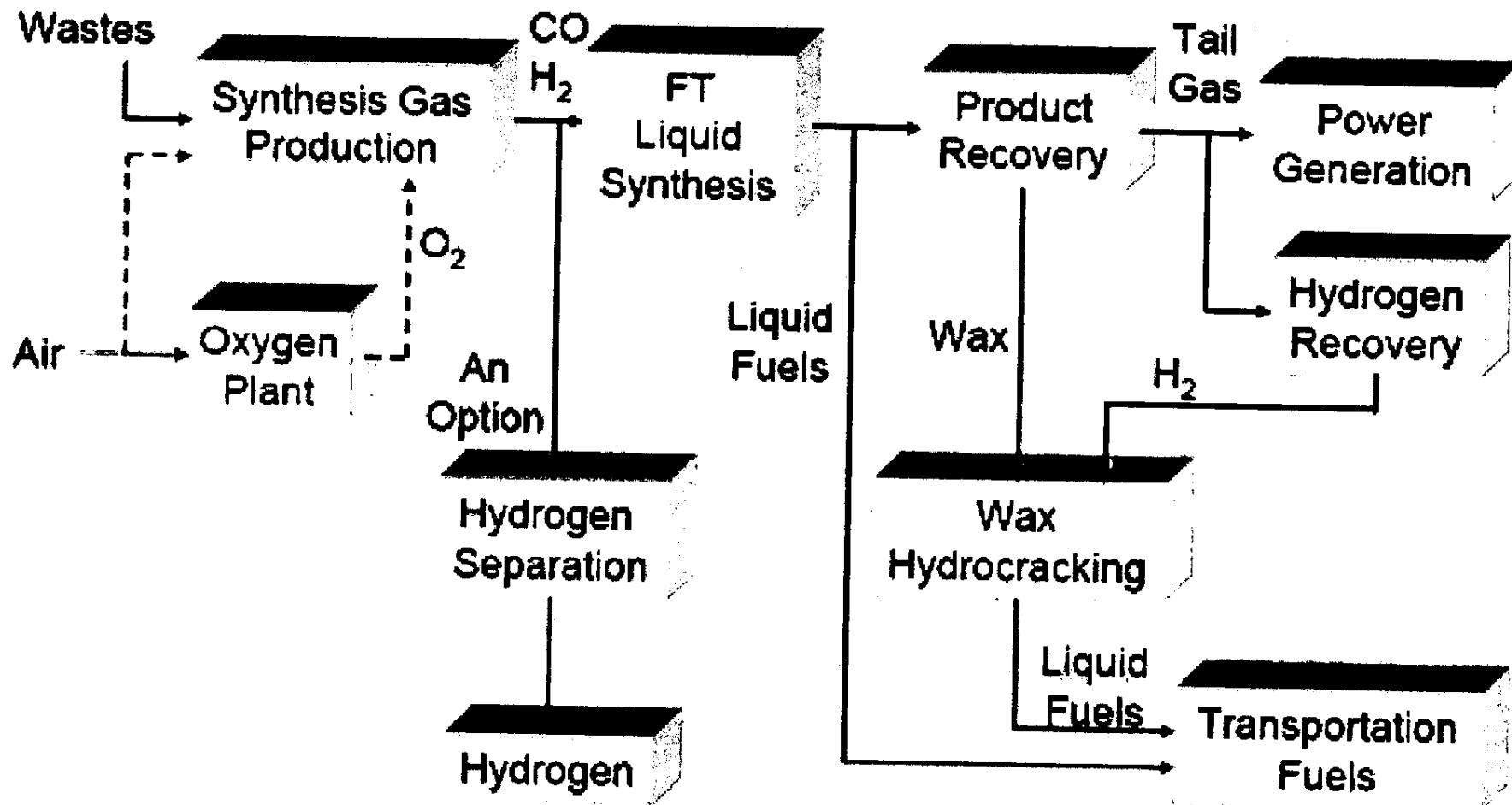
- Carbon Neutral
- Reduced Emissions CO, NO_x and Particulates
- Wide range of liquid fuels can be produced
- FEDC proposal in Fairbanks starts with coal feedstock and transitions to biomass

www.nrel.gov



Fischer-Tropsch Technology

Natural Gas
Coal
Pet Coke
Biomass
Wastes



Conclusions

- ┌ Wood-fired space heating larger buildings is simple, reliable, and widely cost-effective.
- ┌ But wood requires a commitment above oil-fired systems.
- ┌ Power generation is more complex, but small-scale technology is advancing.
- ┌ Chip-fired heating provides a stepping stone to power production in rural Alaska.
- ┌ Biorefineries are the future.

Thanks

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- ★ **Bristol Bay Borough is the Sockeye Salmon Capital of the World**
- ★ **Bristol Bay harvested 173 million pounds of sockeye salmon in 2008**
- ★ **Average waste (throw away) per fish is 30%**
- ★ **57 million pounds of waste is flushed back in to Bristol Bay**

Currently using fish oil as a source of energy:

- 1) Dutch Harbor - Unisea Inc. Renders fish oil for in house energy use**
- 2) Kodiak - Cooperative facility for rendering fish oil and value added fish pellets**
- 3) Juneau - Floating processor rendering fish oil for resale**

A successful co generation of energy facility - Ugashik Community Center

Thank you for your interest in renewable energy. There is a world of energy yet to be discovered.

**Yvonne Kopy, Bristol Bay Borough Planner/ Grant Writer
PO Box 189, Naknek, AK 99633 907-246-4224
email: planning@theborough.com**



Naknek Electric Association, Inc. Proposed Regional Geothermal Generation Project

December 2007

Naknek Electric Association, Inc. (NEA) is exploring geothermal power production in an effort to improve its ability to provide reliable and affordable electricity. The cooperative faces an urgent need to identify sound alternatives to diesel generation due to the increasing and unpredictable costs of fossil fuels. These costs threaten the economic health and sustainability of the Bristol Bay and Lake Regions of western Alaska. Recently, the diesel fuel surcharge, which is reflected in the electric rate charged to NEA consumers, has increased by about 68% or more than \$73.00 per month for a typical residential customer. Information indicates that development of geothermal power production will stabilize and lower electric rates in Naknek and throughout the region where approximately 6,500 people live in 25+ isolated rural communities.

Bristol Bay is considered the Sockeye Salmon capital of the world. In recent times, the harvest of Sockeye Salmon in a single summer topped 45 million fish. Since the area has a natural economic base, lowering the cost of electricity is expected to significantly improve the local economy. If energy costs can be reduced several seafood processors have indicated they would be interested in extending their seasons in the Bay to include secondary processing of salmon.

NEA's interest in geothermal power took root over a decade ago when the cooperative began researching local geothermal energy potential. It found considerable research data completed within the Katmai National Park and Preserve which warranted further exploration. The park boundary lies just a few miles from NEA's electric lines. During preliminary discussions with federal officials, it appeared that gaining access to the identified potential resource through park and refuge lands would be excessively expensive and time consuming. NEA continued to watch for geothermal opportunities, and focused on improving diesel production efficiency and other efforts to stabilize electric rates.

NEA found that today's drilling technology supports the development of geothermal resources at approximate depths of 10,000 feet or more. Therefore, it may be possible to find a resource outside the national park and close to existing road and electric distribution infrastructure. NEA is currently assessing local geothermal resources, available geothermal power technologies and options for a transmission system that will extend the benefit of geothermal resource development to all communities in the region.

Thus far, NEA has completed research, review, and assessment of thermal imagery map overlays, oil well production and log data, and regional faults and fractures data. It has also completed surface testing, which shows the presence of minerals indicative of an underlying geothermal resource, and has drilled three shallow test wells, reaching bedrock. NEA just finished its thermal probe testing, while seismic 3D modeling is currently still in progress. Data from both methods of analysis will be available in mid December of this year. NEA hopes the data provided will assist in determining which site is optional for drilling a deep well of 10,000+ feet.

With resource identification, NEA proposes construction of a 25 MW geothermal plant serving 25+ villages within the Bristol Bay and Lake Regions. This project would be the first utility-grade geothermal development in Alaska. The initial cost estimate for the plant and approximately 450 miles of transmission line interconnecting regional villages is \$200 million. Over the past decade NEA has invested approximately \$1 million in initial research and exploration of renewable alternative energy and is committed to being a financial partner as the project proceeds. NEA is approaching both state and federal governments for matching assistance.

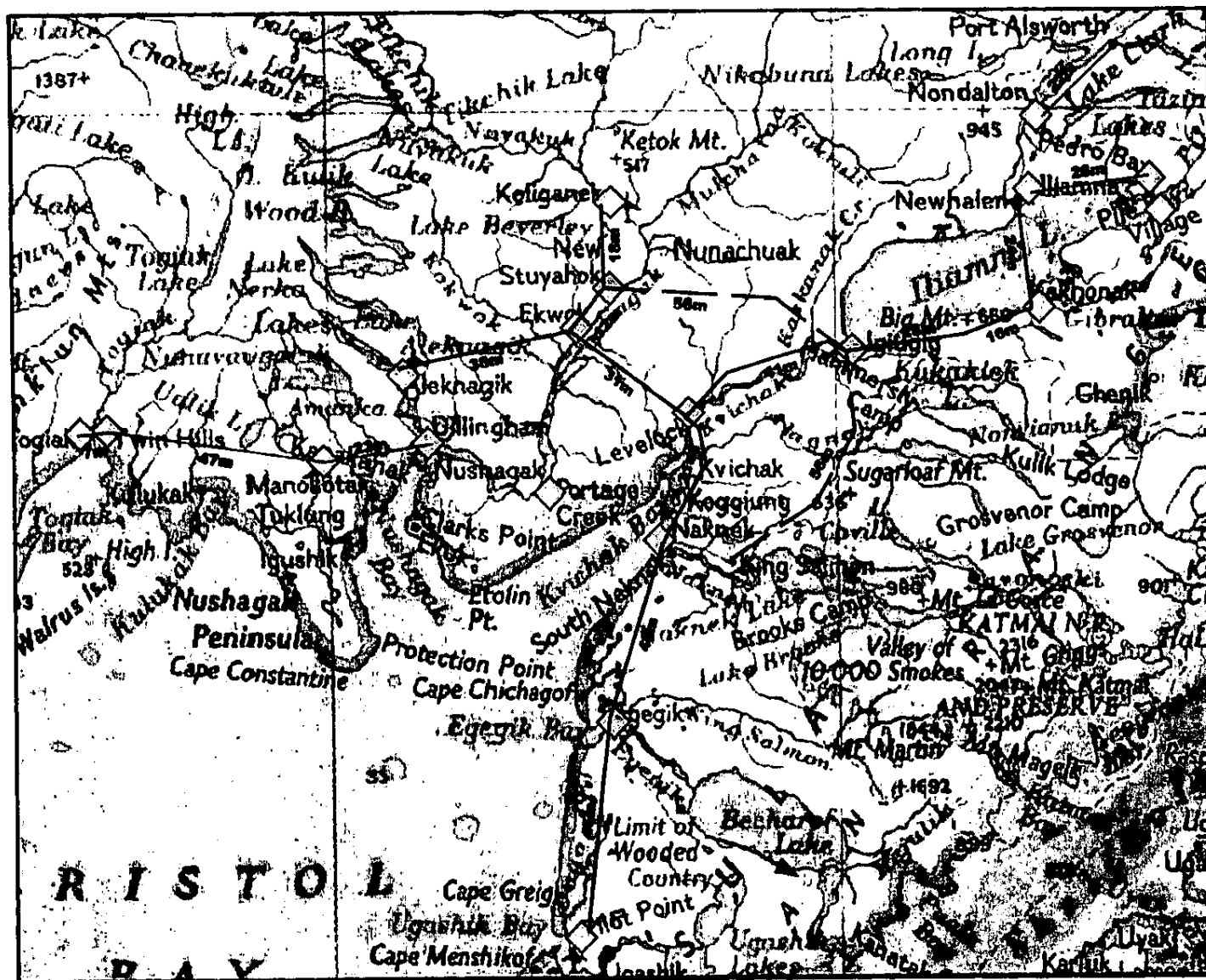
Proposed Project:

- 25 MW Geothermal Generation Facility
- 450 miles of transmission lines to bring electric energy to 25+ villages. Lines would extend from Naknek/King Salmon to Pilot Point; to Iliamna/Port Alsworth; and to Dillingham/New Stuyahok/Togiak and beyond
- Initial Load: 18 MW with full potential to use 25 MW within two years

Benefits:

- Dramatic drop in the cost of power production, estimated to decrease 70%
- Cleaner environment with elimination of 3.5 million gallons of diesel fuel now used to generate electricity
- An energy base for long-term economic development sustaining local communities

While NEA's interest in the project focuses on production of electricity, identification of a geothermal resource could bring many other benefits, including hydrogen production, hot water heating to nearby communities, and the development of spas, greenhouse projects, and other related businesses.



**PROPOSED
REGIONAL
GEOTHERMAL
DISTRIBUTION
NETWORK**

424 Miles Overhead
24 Miles Under Lake Iliamna

$424 - 41 - 31 + 56 + 56 = 464$ m

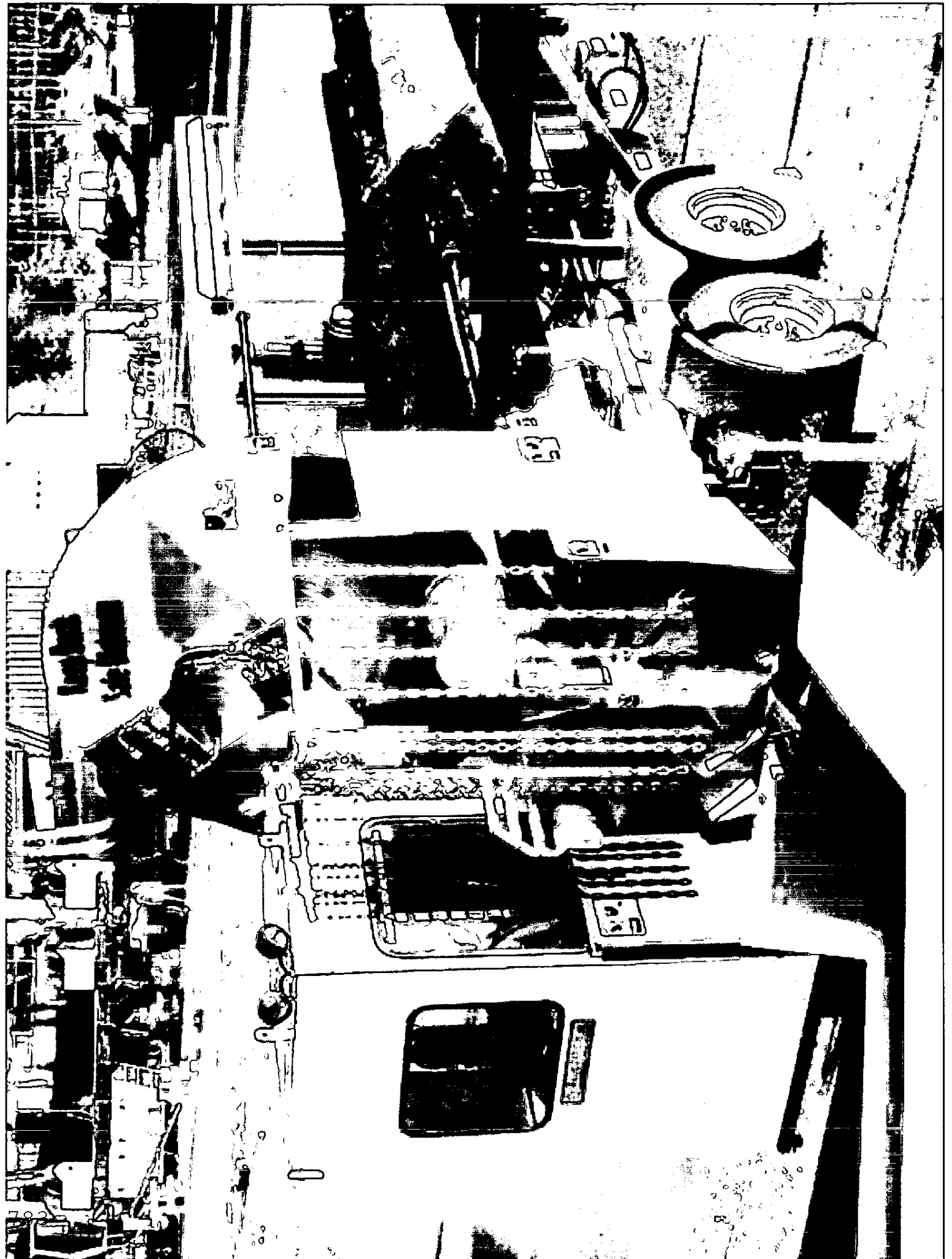


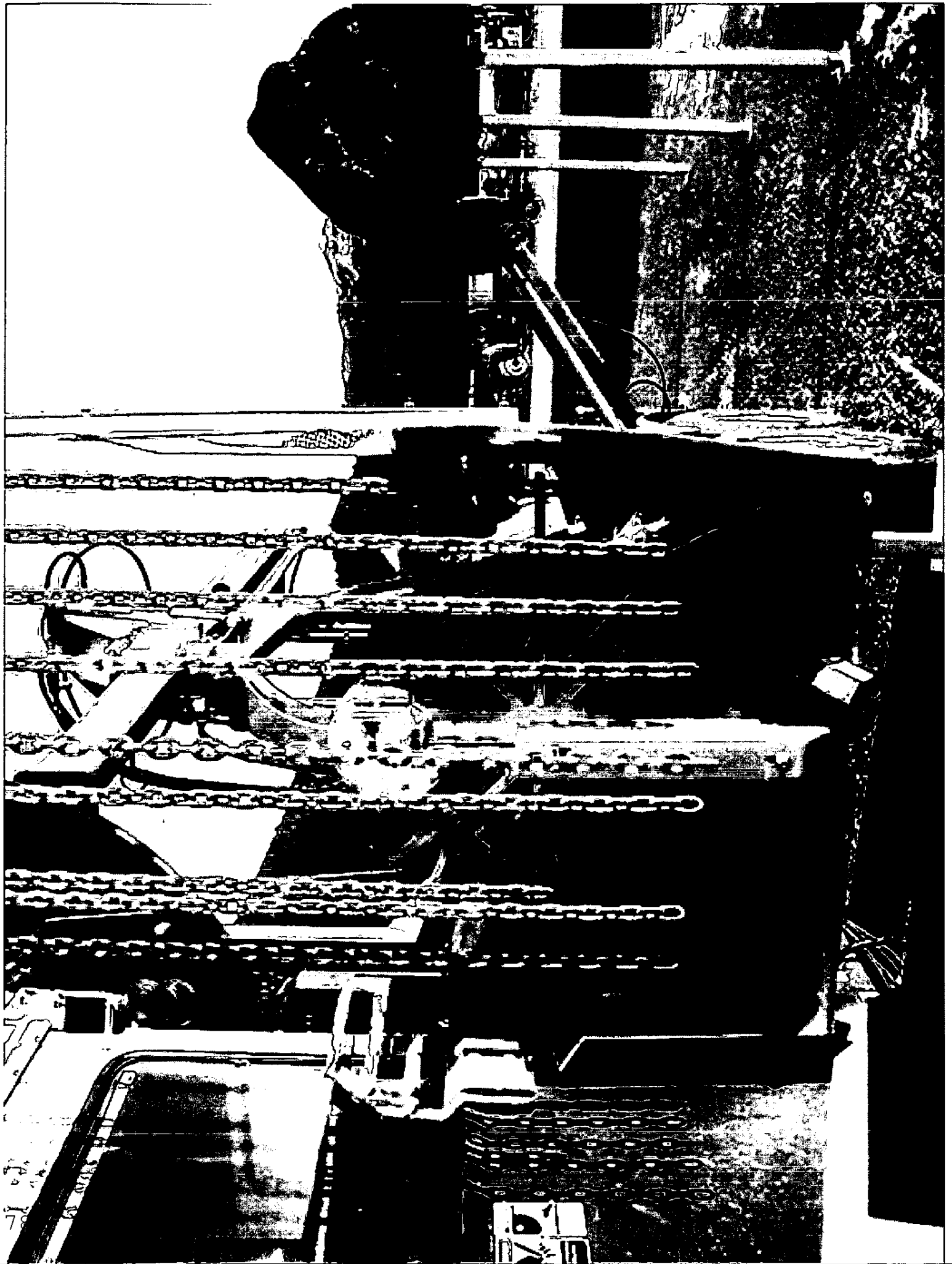
NOTE: ALL SHOWN DISTANCES ARE APPROXIMATE MILES

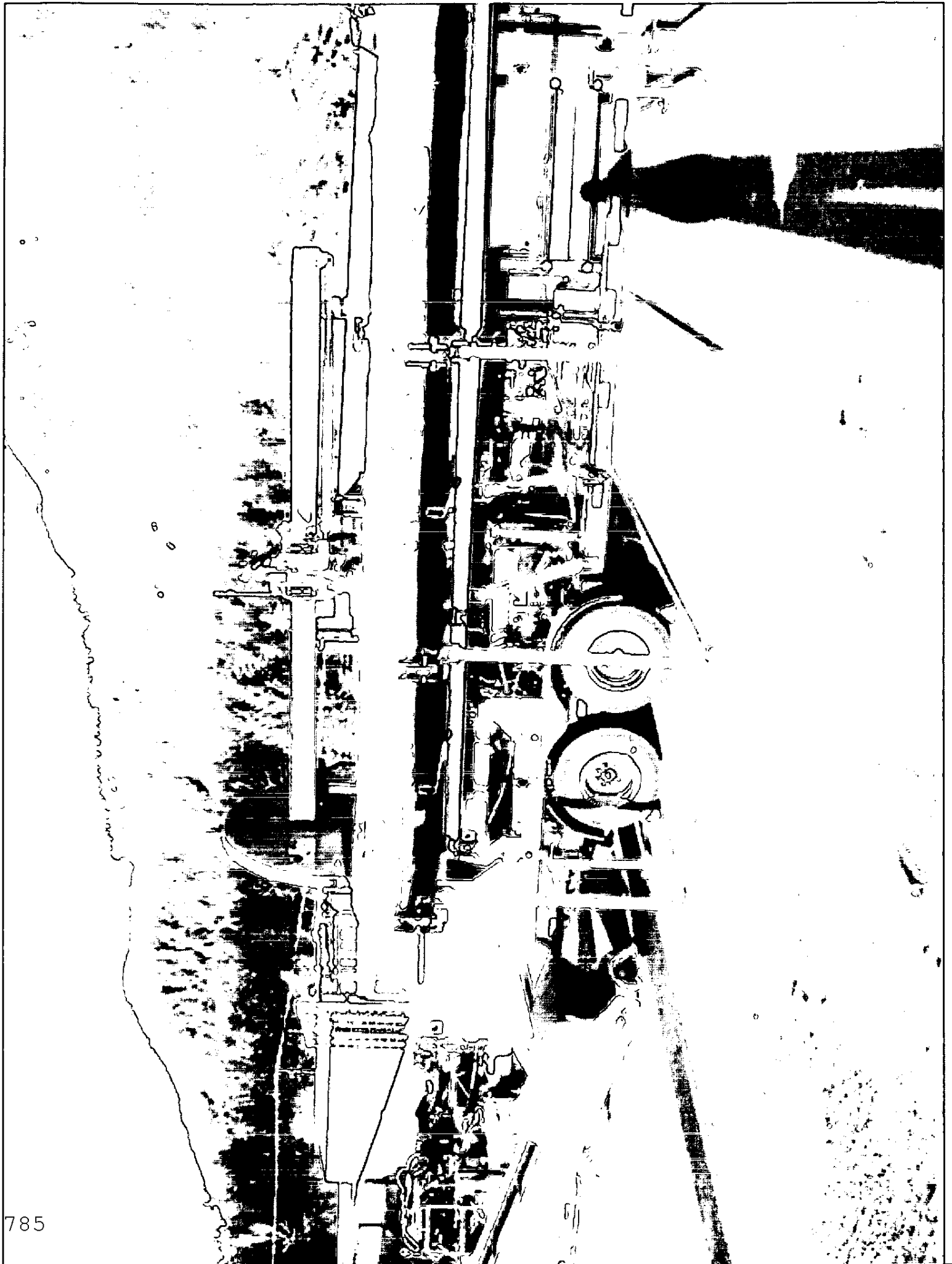
PREPARED BY
COASTAL SURVEYORS
FOR
NAKNEK ELECTRIC COOP

APPROXIMATE SCALE in MILES



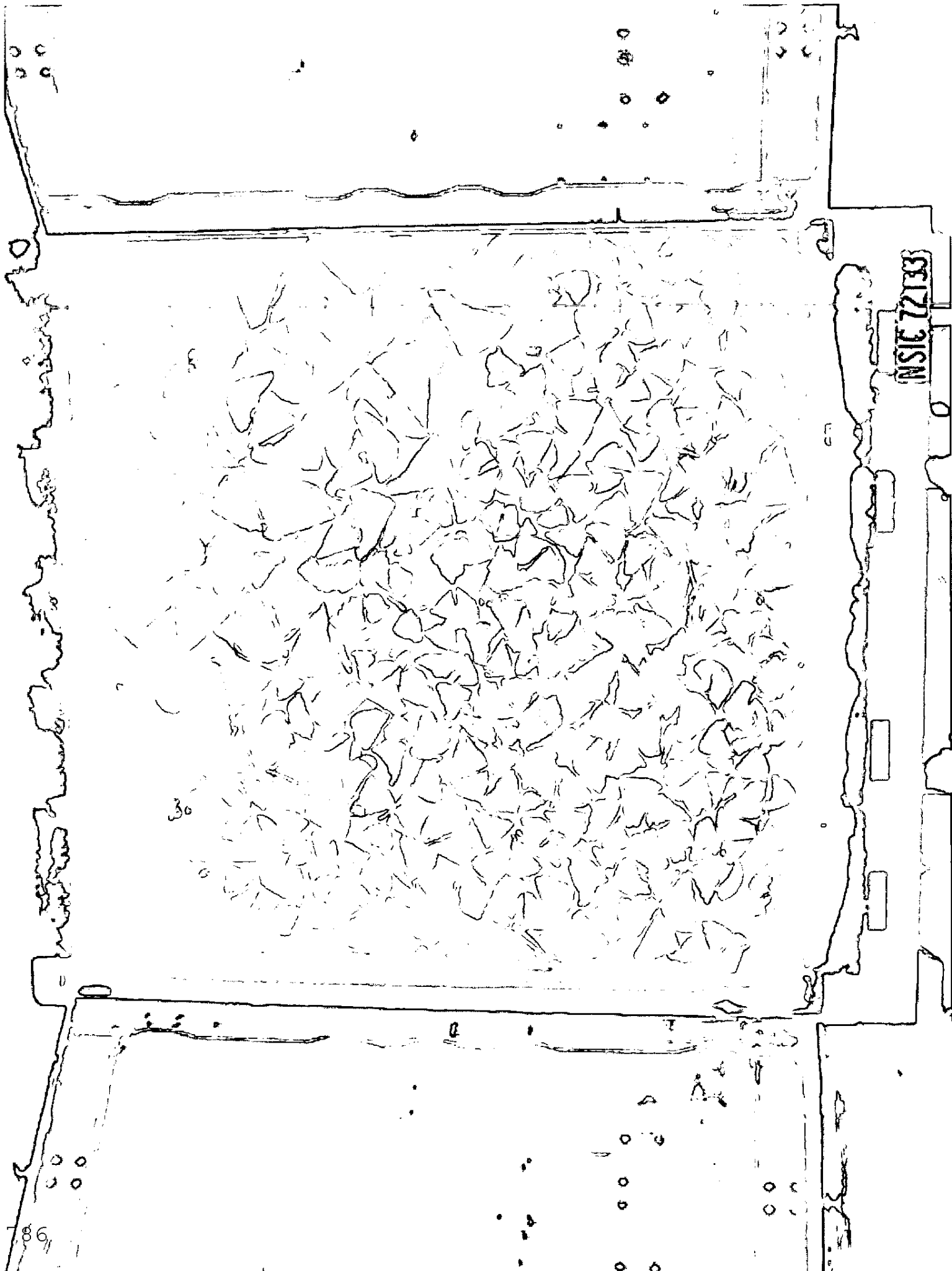






NSIC 72133

30





Our New Generation



Stukhoutverbranding

KOB
PYROMATECO



Efficient met energie.

1. Grootte van de oven
2. Energiebesparing

3. Energiebesparing

4. Energiebesparing

5. Energiebesparing

6. Energiebesparing

7. Energiebesparing

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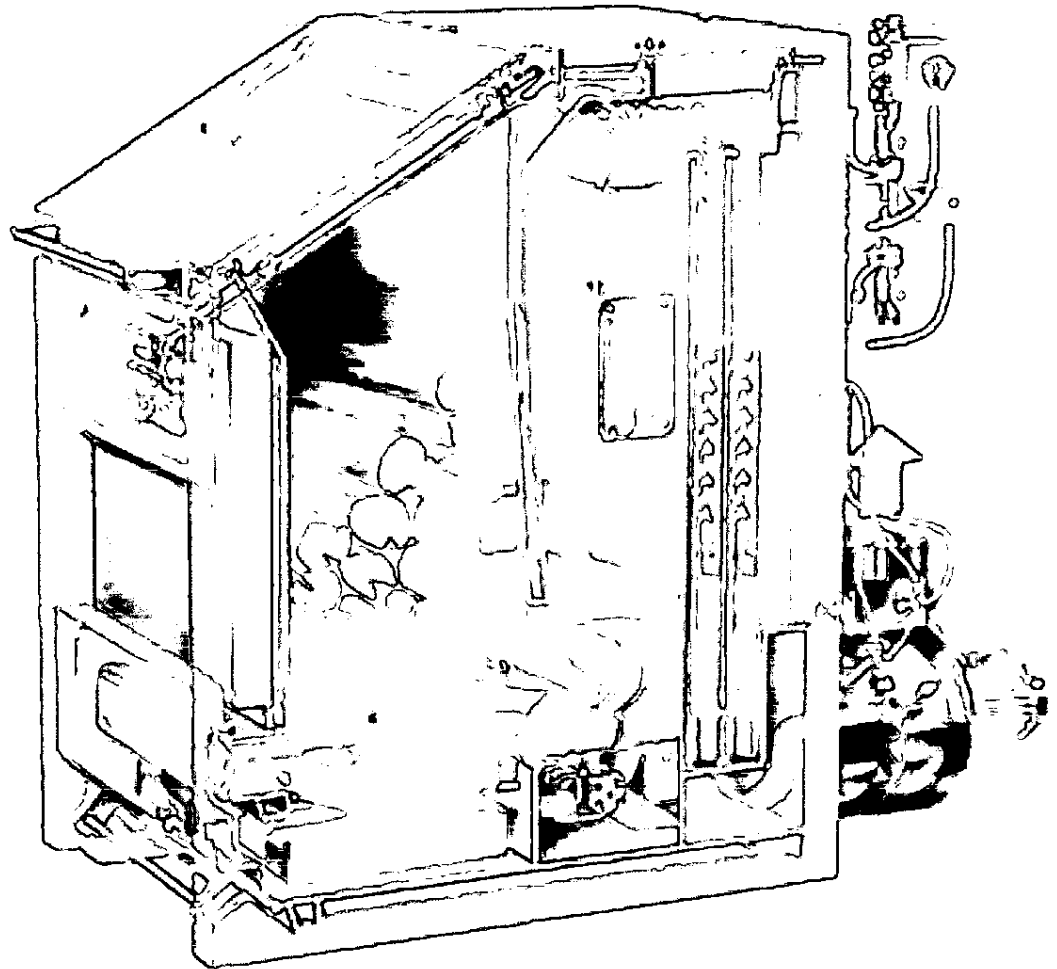
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PYROMAT ECO
Witbreedte 550mm

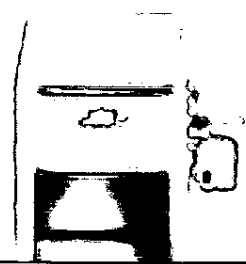
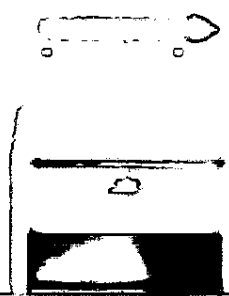
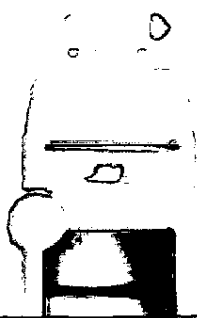
Energiebesparing 30%

PYROMAT ECO
Witbreedte 600mm

Energiebesparing 30%

PYROMAT ECO
Grandopening

Energiebesparing 30%
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Energiebesparing 30%



WOOD TO ENERGY

Wood is a viable source of energy producing BTU's of heat at a cost to the consumer comparable to electricity when produced by hydro, wind, coal or natural gas. Wood burning appliances that employ new technology provide a safe, efficient and clean means to convert the readily available supply of wood fiber in many regions of Alaska to a reliable, environmentally friendly and economic source of fuel to heat residential and commercial buildings.¹

FIBER SUPPLY

In Southeast Alaska, the commercial harvest of timber from the Tongass National Forest on lands owned by the Federal Government, State, Alaska Mental Health Trust, University of Alaska and Sealaska all generate a substantial volume of logs not suitable for sawing. This material is currently chipped and sold to pulp and paper mills or left in the woods. Pacific Log & Lumber, a sister company also owned by the Seley Family Partnership will harvest approximately 25 Mmbf of timber annually to supply saw quality logs to its sawmill in Ketchikan. Approximately 30% of the timber harvested is unsuitable for the manufacture of lumber and in recent years has been chipped and transported for sale to Pulp and Paper mills in Canada and Washington.

Alaska Chip currently maintains a decked log fuel wood inventory of approximately 1.8 Mmbf. Based upon a conversion of 209 CF per Mbf and 85 CF solid wood equivalent per cord, this inventory will yield approximately 4,425 cords of wood. The annual total volume of logs harvested by Pacific Log & Lumber not suitable for producing sawn lumber is approximately 7.5 Mmbf yielding 33,187 cords.

When you consider that one cord of hemlock will yield the same BTU value as 157 gallons of #2 diesel, it is easy to grasp the potential benefits that our wood fuels program will generate for our Customer, our Communities and our Company. There are many factors that affect the delivered cost of home heating fuel to the consumer with most of them outside the control of government or the consumer. Alaska Chip can predict the future cost of wood fiber up to 12 months in advance of production and is giving ample notice of price changes to the customer.

The Tongass Land Management Plan recently released by the US Forest Services identifies a sustainable annual harvest of 267 Mmbf. With a 30% fuel wood component, this supply source alone has the ability to replace 31 Million Gallons of #2 Diesel heating fuel.

MARKET

The conversion of logs to a transportable form will entail the production of split wood, commonly known as cord wood and wood chips blended with bark and sawdust (bio-mass). Many homes in Alaska currently have a wood burning stove or fireplace as a secondary heat source. They are often used simply for the ambiance created by the crackling fire and visible

¹ Pellet Fuels Institute "Compare Fuel Costs" calculator
www.pelletheat.org/3/residential/compareFuel.cfm

flame or the pleasure derived from wood heat on a cold and damp day. With the high cost of heating oil, this secondary means to heat the home has in many cases become the primary source.

When researching the market, we found that many elderly citizens prefer burning wood but have until now, been unable to locate a supplier who can guarantee delivery of seasoned split wood to their home.

Most new wood fired boilers are an environmentally acceptable means to produce heat for larger homes, commercial buildings and multiple tenant dwellings. In this application it is preferred to utilize wood in a chip or pellet form. The consistent size of the wood fuel allows the transfer of fuel from on-site storage to the boiler by a mechanized means such as an auger or moving bed system.

The proximity of the end user to the fuel source, thereby reducing transportation cost and the current cost of oil or electricity will determine the economic viability of wood energy as a primary heating source on a region by region basis thus establishing the marketplace.

With a commercial supply of wood fuels and the availability and distribution of environmentally safe and efficient wood fired stoves and boilers, people in the tree growing regions of Alaska will benefit the most by converting to wood energy as their primary heat source. Even with the initial investment to purchase a wood fired boiler or wood stove, burning wood instead of oil will result in a savings of 50-60%.

The attached Brackley statistics estimate the total green tons of wood required to replace oil as the primary heating fuel of both the residential and commercial sectors from Yakutat to Ketchikan is 592,951 green tons or a log equivalent of 104,026 Mbf. The communities of Juneau, Sitka and Ketchikan that we consider our primary market due to the transportation advantage total 75,396 Mbf (72% of the total Southeast Alaska usage) or 171,903 cords. The single processor that we are operating today will produce 30,000 cords of split wood a year operating at full time two shift capacity to meet 17% of the existing demand.

As a Nation, lowering our dependency on oil may be one of the most important tasks we face. 20,238 homes located on the Alaskan Panhandle from Yakutat to Ketchikan burn 14,581,479 gallons of diesel as the primary heat source.² This dependency on oil could be significantly reduced by converting to wood fuels.

WOOD BURNING APPLIANCES

Utilizing heating appliances like those developed, improved and operated in Europe today minimizes the cost of conversion to wood burning technology. A modern boiler can be ordered to operate on split wood, pellets, chips, coal and other manufactured products.³ The KOB (German manufactured) units are specifically developed to burn wood and are far superior to conventional

² Department of Energy, Energy Information Administration publication

³ KOB PYROMAT DYN model 45, 65, 85 www.koeb-schaefer.com

heating systems with regards to economic efficiency, operating safety and user-friendliness. All operating phases are continuously monitored by microprocessors and controlled fully automatically. The result is perfect, emissions-optimized regulation of the output. With the use of very modern technologies, maximum comfort, environmental protection and reliability are achieved.

The European environmental standards for air quality very stringent. These wood burning appliances operating on wet wood chips utilize an automatic variable drying system at the front of the boiler. The wet wood chips are pre-dried in a special auger module. Through a heat exchanger, air is preheated to about 80 degrees C and blown into the auger with the wood chips. Uniform drying is accomplished by the movement of the chips inside the large auger. The exhaust temperature controls the output of the pre-drier. If dry material is introduced the heat output is reduced. In the area of fuel storage and loading, each system requires individual planning.

There are many wood stove manufacturers in the United States and abroad. The quality and capability of the stove is generally synonymous with the purchase price. Most manufacturers have focused on design, efficiency and affordability and provide a variety of options and safety features to the buyer. Most stoves are designed for installation in mobile homes and meet EPA Phase II standards with emissions at 3.1 to 4.5 grams/hr when burning seasoned wood. These stoves are generally of steel or cast iron construction with the burning chamber lined with fire brick, pressed vermiculite or another material extending the stove life.

While there are many stoves to choose from, it is important that homeowners are motivated to choose a model that has been designed for safe operations and minimized emissions. In Oregon, about 94,000 homes burn wood for heat. Half of these homes do so in wood stoves. Oregon environmental officials enacted the first wood-stove emission regulations in the mid-1980's, which the EPA later used as its model for federal standards. The Oregon Department of Environmental Quality is pursuing legislation that would require replacement of "non-certified" wood stoves when a home is sold.⁴

TRANSPORTATION COSTS

Our greatest challenge with fuel wood has been to determine the most efficient and affordable transportation system to move our product to the customer. Communities in proximity to commercial forest harvest operations will enjoy the lowest possible cost for wood energy. The ability to provide wood heat as a competitive energy source is inversely related to the distance from commercial harvest operations and the transportation cost of the wood fuel. Of course this relationship applies to all forms of energy shipped to Alaska - especially heating oil which unlike wood, must be shipped from the Lower 48.

⁴ Statesman Journal November 2, 2006

In order to utilize available barge space on existing common carriers, our shipping containers must meet certain criteria in regards to size and weight for stowage onboard these vessels in conjunction with 20 and 40' boxes commonly used by transporter. They must be efficiently loaded at our plant, easily discharged at the customers location and then returned for refilling. No specialized equipment or handling is required to move split wood in this fashion from the production site to an Alaska community located on the water. Open top gondolas or ½ high's, currently utilized to ship waste best meet these requirements but are in short supply and represent a substantial expense to purchase.

ADVANTAGES OF WOOD FUEL

The most important advantage of wood fuel is that it is grown in Alaska and is plentiful, cost effective and environmentally safe compared to other available fuels. Unlike fossil fuel, burning wood is carbon neutral. The need for expensive tank farms is eliminated as wood can be stacked out doors and tarped if a warehouse, hangar or other covered building is not immediately available. If wood gets wet unlike a pellet, it can be easily dried. Unlike diesel, extreme cold temperatures have no effect on burn ability. The potential liability from a leaky oil storage tank has been eliminated completely.

Wind turbines will work when a steady wind of 8-40 knots can be maintained 80% of the year, provided a grid of sufficient size is available to blend wind produced energy with diesel, hydro or other base load.

Hydropower is plentiful in Alaska, but includes the cost of transmission lines and is economic only when demand will be sufficient over time to amortize the initially high capital cost. Moreover, hydropower has long lead permitting and construction time lines and is subject to litigation. With 90% of the Alaska communities having fewer than 5,000 homes and no common grid to tie them together, neither hydro nor wind produced power will be as cost competitive in most places. In those areas of Alaska in which hydropower will be determined to be more competitive than wood fuel over the long term, wood fuel can be a short term solution until the hydrofacilities are built and operating and then provide a reliable backup for periods when hydropower is interrupted.

TIME FRAME

The need for wood fuel as an alternative to diesel is immediate. Due to fluctuations in the delivered cost of diesel, many residents in Southeast Alaska have shut down their diesel fired boilers and have plugged in portable electric room heaters. Local utilities in Ketchikan and Sitka are unable to meet the forecasted demand for electric power during portions of the winter months without the use of diesel generators. As the Legislature and the Administration have already determined, the cost to heat a home in Southeast Alaska (or anywhere else in Alaska) in winter with diesel fired generators is significant. With governmental assistance to promote conversion to wood fuel, annual heating costs and dependency upon diesel can be significantly reduced.

The Renewable Energy Fund and grant program represents recognition of the problem and a substantial investment in resolving it. I challenge the Legislature to invest a portion of the funds in projects that provide an immediate benefit. Give high consideration to applicants who are willing to match dollar for dollar in investment. Support the development of new concepts but don't overlook proven technology. Alaskan's need relief from the uncertainty and high delivered cost of diesel today.

BUSINESS MODEL

Alaska Chip will implement it's wood to energy plan in three steps;

- A Split Wood for residential usage
- B Chips for residential and commercial chip fuel boilers
- C Bio Fuel production

Alaska Chip has invested \$500,000 in new equipment to produce wood fuel. Our Multitek 4030 processor has been delivered to Ketchikan and we are producing cord wood with distribution points in Ketchikan and Juneau. Our distribution will be expanded to Sitka in the near future.

The Forest Service and Coast Guard have issued contracts to engineering companies to study the potential for converting facilities located in Southeast Alaska from oil fired to wood fired boilers. In both cases these companies have concluded that wood chips provide the best source of wood fuel as they can easily be metered to the boiler from a storage silo depending upon the demand for heat. We have also found this to be true in Europe where we have studied wood fuel heat systems that have been operating for many years.

Alaska Chip currently produces approximately 15,000 Green Tons of wood chips a year that are sold to pulp and paper mills. We have the ability to expand our production to 55,000 Green Tons.

An equally important part of implementing this plan is to source the best chip fired boiler for this region. In addition to providing raw material, we will train employees to sell, operate and service these boilers. While there are several that appear to meet our needs, the final choice will be made after the Forest Service and Coast Guard studies have been completed.

For commercial accounts, Alaska Chip will offer an energy contract allowing the customer to immediately realize the cost benefits of converting from an oil-fired to a wood fired system. Existing heating equipment will remain in place. The customer will provide adequate space to install the wood fired boiler and chip storage silo in or next to the building. Alaska Chip will own, operate and maintain the boiler system and the necessary supply of wood fuel.

There are several companies interested in bringing biofuel technology to Alaska. Alaska Chip has entered into a working agreement with one of these companies who specializes in catalyst development and gasification and follow a course based on the Fischer Tropsch process, which is

the conversion of gas to liquid fuel using a catalyst. Alaska Chip's active participation is limited to providing biomass and plant site location.

SUMMARY

The demand for affordable energy and the quantity of diesel used today to ultimately meet most energy needs from Yakutat to Ketchikan have been quantified by the Forest Service in the attached reports. Information regarding demand and usage in coastal communities in Western Alaska is also available from other sources.

A viable, sustainable and economic supply of fuel wood exists on the Tongass National Forest. This often under utilized component of the forest is left in the woods or chipped and barged to pulp and paper mills 800 water miles to facilities in Washington and Canada. Can it provide a greater economic benefit utilized in Alaska?

The Seley Family has the longest continuously operating forestry related business in the State of Alaska today. We see wood fuel as an important component in our business plan to insure that we can continue operating profitably and have directed our investment in infrastructure accordingly.

GOVERNMENT ASSISTANCE

This business model complies with the stated goals of the State of Alaska to promote and support a reduction in the cost of energy for Alaskans, particularly in the winter. While we meet the stated intent of the Alaska Energy Authority's Renewable Energy Grant Program, we were clearly not an eligible applicant based upon the criteria in section 1.4 of the application. Not being a government entity or an electric utility removed 3 of the 4 types of entities that would qualify leaving "a legal entity that owns or operates facilities for the generation of energy". While we felt we could make a pitch towards qualification under this criteria, it would be difficult at best.

We have made our initial investment of \$500,000 to purchase equipment and make facility improvements as necessary for the commercial production of split wood. This investment was justified on the needs expressed by Ketchikan and Sitka alone and without assistance from the State or Federal Government. This startup business is operating and meeting both our cost and sales projections. We would like to expand the business to match our production capacity, fiber supply and market demand.

We read and hear about the demand for wood in Western Alaska communities and villages and the cost of fuel oil in that region. In each case, the viability of converting to wood will depend upon transportation costs.

The power cost equalization program provides financial assistance to many rural communities by effectively subsidizing the cost of energy resulting in a cost to the State. I believe there is an opportunity to reduce this expense substantially to both the State and the consumer with wood fuel.

Today I am requesting the assistance of the State of Alaska and specifically the Legislators representing the many coastal communities to assist in determining demand and the potential cost savings to both the end user and the State.

Steve Seley Jr.
President - Alaska Chip Ltd.
(907) 225-2692
(907) 617-7440
s.seley@seley.com

Estimated volumes of wood required to replace fuel oil currently used by Residences and Commercial Sector users in various communities in Southeast Alaska. This table has been prepared using 2005 Census Data and Department of Energy, Energy Reporting Agency Data. Commercial Sector estimates based upon a level of use 1.47 times that of Residential Users. Prepared by: Allen M. Brackley, July 2008

	Census District	Number homes using fuel oil	Average fuel oil usage (F32 AK Energy Use gallons)	Therms @ 135,000/gallon/100,000btu	Bone Dry Tons wood at 164/bdt (see Q30) "AK Energy Use"	To totally replace fuel oil in heating all homes (bdt)	To meet Commercial use (schools, municipal buildings, etc) Residential * Factor of 1.47 (bdt)	Total to meet the needs of Residential and Commercial Sectors - Industrial, Transportation and Power Generation not considered (bdt)	Green Tons	Cords at 2.5/green ton	MBF equivalent of traditional logs at 5.7 tons/MBF
SE	Haines	706	508,673	686,709	4,187	4,187	6,155	10,343	20,685	8,274	3,629
SE	Juneau	8,131	5,858,386	7,908,820	48,225	48,225	70,890	119,115	238,229	95,292	41,795
SE	Ketchikan	4,145	2,986,473	4,031,738	24,584	24,584	36,138	60,722	121,444	48,578	21,306
SE	Prince Wales - Outer Ketchikan	1,420	1,023,110	1,381,199	8,422	8,422	12,380	20,802	41,604	16,642	7,299
SE	Sitka	2,392	1,723,436	2,326,639	14,187	14,187	20,855	35,041	70,083	28,033	12,295
SE	Skagway-Hoonah-Angoon	1,050	756,525	1,021,309	6,227	6,227	9,154	15,382	30,764	12,306	5,397
SE	Wrangell-Petersburg	2,152	1,550,516	2,093,197	12,763	12,763	18,762	31,526	63,051	25,220	11,062
SE	Yakutat	242	174,361	235,387	1,435	1,435	2,110	3,545	7,090	2,836	1,244
	Total	20,238	14,581,479	19,684,997	120,030	120,030	176,445	296,475	592,951	237,180	104,026

Note: The Department of Energy, Energy Information Administration publishes data that reflects the total btu equivalents of various forms of energy that are used in the United States. This information is available for each of the states. The published information is divided into sectors (Residential, Commercial, Industrial, Transportation and Electrical Power). In this table the btu values for distillate fuels (classification used for heating oil) have been converted to gallons of oil based upon a Gbtu value of 135,000btu/gallon. The values in this table represent an equivalent volume of wood at a Gbtu value of 8,200 btu/pound (164 therms/bone dry ton of wood fiber). It is recognized that the actual volumes required must take into account the moisture content of the various forms of wood used to replace the oil and the efficiencies of the specific burning systems (wood stoves, pellet stoves, furnaces, chip burning systems) that are used to replace oil equipment. Ultimately the actual demanded volumes will increase depending upon the form of wood used and equipment. These numbers are intended for planning purposes. It is obvious that a complete replacement of distillate fuels will not take place so ultimate demand will be lower than the values in the table. The above errors will tend to cancel out and the ultimate levels of demand approach the value in the above table.

Region	Borough/Census Area	Utility Gas	Bottled, Tank, LP	Electricity	Fuel Oil Kerosene	Coal or Coke	Wood	Solar Energy	Other Fuel	No Fuel Used	Total Housing Units
GA	Anchorage	79,128	860	12,405	939	35	249	9	625	572	94,822
GA	Kenai Peninsula	7,828	1,240	1,267	6,525	69	1,361	6	98	44	18,438
GA	Matanuska-Susitna	12,296	876	984	4,971	2	1,321	20	65	21	20,556
GA	Valdez-Cordova	117	230	107	3,004	3	403	1	18	1	3,884
	Total	99,369	3,206	14,763	15,439	109	3,334	36	806	638	137,700
		72.2%	2.3%	10.7%	11.2%	0.1%	2.4%	0.0%	0.6%	0.5%	100.0%
GF	Denali	0	10	12	563	68	89	0	2	41	785
GF	Fairbanks North Star	761	389	2,850	22,851	893	906	0	826	301	29,777
GF	Southeast Fairbanks	5	11	22	1,386	0	552	0	120	2	2,098
	Total	766	410	2,884	24,800	961	1,547	0	948	344	32,660
		2.3%	1.3%	8.8%	75.9%	2.9%	4.7%	0.0%	2.9%	1.1%	100.0%
SE	Haines	4	12	22	706	0	240	0	7	0	991
SE	Juneau	159	335	2,574	8,131	0	172	0	153	19	11,543
SE	Ketchikan	28	243	576	4,145	0	260	0	109	38	5,399
SE	Prince Wales-Outer Ketchikan	16	173	109	1,420	0	512	0	23	9	2,262
SE	Sitka	16	70	724	2,392	0	52	0	24	0	3,278
SE	Skagway-Hoonah-Angoon	4	39	53	1,050	2	194	2	23	2	1,369
SE	Wrangell-Petersburg	8	74	156	2,152	0	177	0	16	4	2,587
SE	Yakutat	0	4	8	242	0	9	0	2	0	265
	Total	235	950	4,222	20,238	2	1,616	2	357	72	27,694
		0.8%	3.4%	15.2%	73.1%	0.0%	5.8%	0.0%	1.3%	0.3%	100.0%
SW	Bethel	36	42	128	3,700	3	265	0	38	14	4,226
SW	Bristol Bay	0	0	4	463	0	4	0	2	17	490
SW	Dillingham	3	4	38	1,422	4	41	0	10	7	1,529
SW	Kodiak Island	46	95	257	3,819	0	59	0	114	34	4,424
SW	Lake and Peninsula	1	5	12	527	0	37	2	4	0	588
SW	Wade Hampton	5	5	7	1,453	0	127	0	2	3	1,602
	Total	91	151	446	11,384	7	533	2	170	75	12,859
		0.7%	1.2%	3.5%	88.5%	0.1%	4.1%	0.0%	1.3%	0.6%	100.0%
	Total All	100,461	4,717	22,315	71,861	1,079	7,030	40	2,281	1,129	210,913
		47.6%	2.2%	10.6%	34.1%	0.5%	3.3%	0.0%	1.1%	0.5%	100.0%

FIREWOOD FACT SHEET

Firewood was the primary source of fuel until the 1800s when it was displaced by coal and later by oil. Firewood is a renewable resource, provided the consumption rate is controlled to sustainable levels. Proper forestry practices applied to firewood allow the use of a carbon-neutral, or even carbon negative, energy source, since the carbon dioxide released by the burning of firewood was previously absorbed from the ambient atmosphere through photosynthesis. Because of this, firewood can be considered to be a form of solar energy.

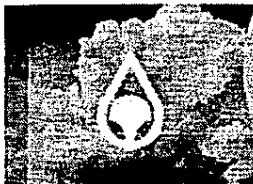
There are approximately 35 million fireplaces in the United States today. The use of wood as fuel is projected to increase by over 50% over the next two decades. Burning wood is environmentally sound. The process does not contribute to greenhouse gases. A growing tree absorbs carbon dioxide from the air and into its molecular structure. When the tree dies and decays, it releases the carbon back into the air. The same thing happens when the wood from a tree is burned. The same amount of carbon is released back into the atmosphere. Thus, burning wood is just a faster reversal of the natural cycle. This is unlike burning fossil fuels such as oil or gas. These fuels will release carbon dioxide, which has been buried in the earth for thousands of years, into the atmosphere.

The common measurement for firewood is by the cord or fraction of a cord. A cord of wood corresponds to a woodpile measuring 4' x 4' x 8' or 128 CF of space. The actual solid wood measurement of a cord depends upon the straightness of the piece, how it is split and how it is stacked. The total cubic feet in a cord can vary from 70 to 90 or more cubic feet.

Cordwood is sold in both a seasoned and unseasoned form. Seasoned wood generally has been split, stacked and air dried until the wood reaches equilibrium with the moisture in the surrounding air.

Of the 39 species of wood predominate across the United States, Hemlock ranks number 14 in production of BTU's per cord. Alaska Yellow Cedar is another good specie that is preferred by many in the Southeast Alaska region. Seasoned hemlock generates 8,000 to 8,500 Btu per pound. (Cord weight dry 2,590 lbs - 21,377,500 Btu/cord) A gallon of oil produces 136m Btu's. Approximately 157 gallons of oil is required to produce an equal number of Btu's to one cord of hemlock.

To easily compare energy costs per Btu from various sources, go to WWW.Seley.com and navigate to Alaska Chip & Firewood Sales. Click on Firewood Facts. Scroll to the bottom of the page and click on the BTU efficiency calculator. This will link to the Pellet Fuels institute site where you can enter your current cost of Wood Pellets, electricity, delivered Fuel Oil, propane, natural gas, Coal or Wood to determine the most efficient source of heat in your region.



PELLET FUELS INSTITUTE

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- What is Pellet Fuel?
 - Burning the Fuel
 - Compare a Fuel
 - Fuel Availability
 - Brochure
 - FAQs
 - Benefits
 - Find a Retailer
- Pellet Fuels Institute
1901 North Moore St
Suite 600
Arlington, VA 22209
(703) 522-6778

Compare Fuel Costs

Pellet fuel is a cost stable and price competitive fuel. A good way to understand the price benefits of pellet fuel is to compare it against other home heating fuels. The following chart can assist in comparing home heating fuels.

The values shown are national averages. You may enter your own costs to compare. Enter amounts in dollars except for the cost of electricity, which is in cents. Do not enter a decimal point.

Wood Pellets Cost per ton in dollars \$ 225 Appliance Efficiency 80 % Cost per million BTU=\$17.15	
Fuel Oil #2 Cost per gallon in dollars \$ 3.26 Appliance Efficiency 78 % Cost per million BTU=\$30.29	Electricity Cost per kWh in cents 10 ¢ Appliance Efficiency 100 % Cost per million BTU=\$29.31
Natural Gas Cost per therm in dollars \$ 0 Appliance Efficiency 78 % Cost per million BTU=\$0.00	LP Gas / Propane Cost per gallon in dollars \$ 2.47 Appliance Efficiency 78 % Cost per million BTU=\$34.67
Hardwood (air dried) Cost per cord in dollars \$ 190 Appliance Efficiency 60 % Cost per million BTU=\$15.83	Coal Cost per ton in dollars \$ 0 Appliance Efficiency 75 % Cost per million BTU=\$0.00

Calculate

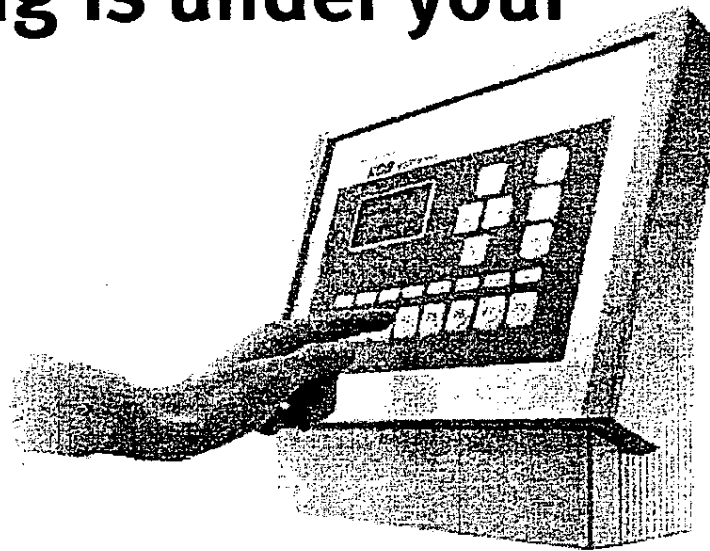
Heating with Logs.



Everything is under your control.

Our new generation

Our PYROMAT ECO, specially built to extract heat from wood, incorporates the latest combustion technology.



Multiple fuels



Logs



Briquettes

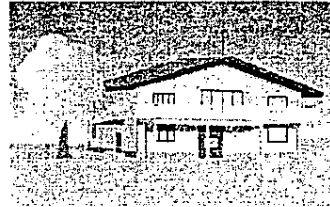


Joinery waste, shavings and sawdust

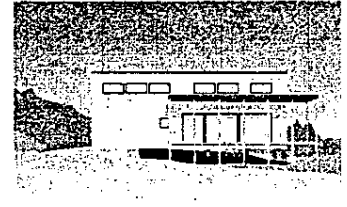


Offcuts and scrap

A wide variety of uses



Agriculture/Businesses



Detached homes

Slow burning for long lasting heat generation

The capacity of the loading chamber can be used to its maximum. With good heating system design and configuration, a single load of fuel can provide heat for up to three days.

Easy-to-fill

The filling lid is supported by a preloaded gas spring that helps make it easy to open. The various fuel types are easily loaded from above.

Emission-free operations

The exhaust blower starts at the touch of a button - quickly firing up the system. While heating, when refilling and during cleaning, the exhaust blower prevents all smoke and dust emissions.

Easy-to-clean

The ash box can be emptied with the exhaust blower without causing any formation of dust.

Completely computer controlled

The micro processor in the ECOTRONIC controller collects all the relevant operating data and controls output to meet the current demands for heat. The heating system is permanently monitored - in all phases of its operations, from firing up - to heating up - to refilling - up to the burn out phase. Its operating efficiency is kept at an optimum with motorized air vents.

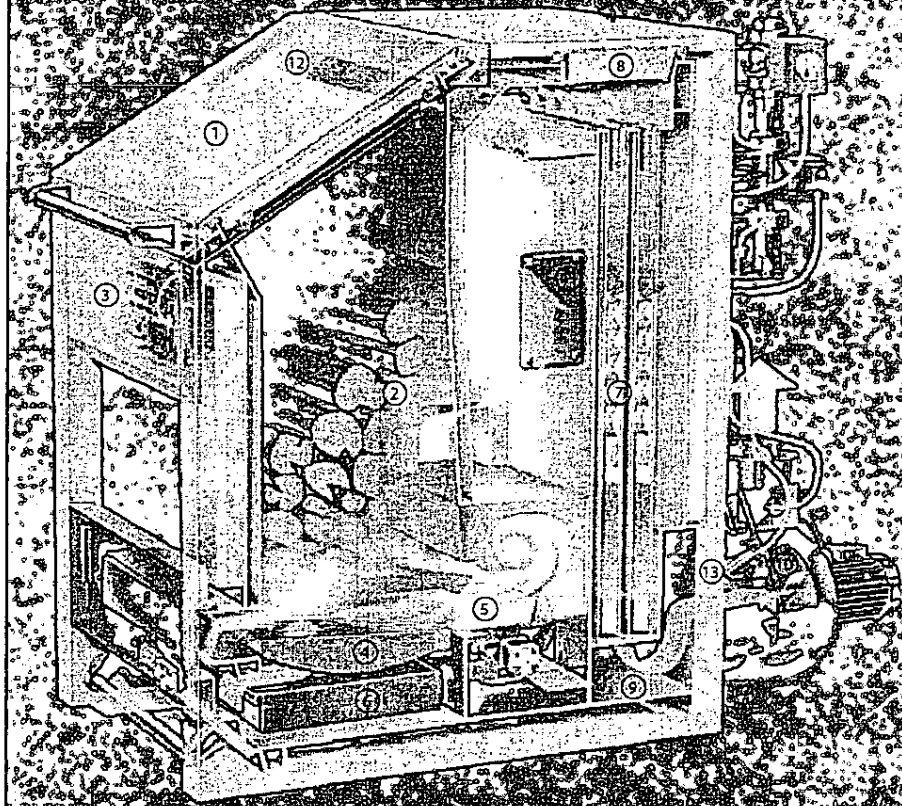
Easy-to-operate

The boiler and heating systems can be controlled at the touch of a button. The control panel with its well laid out buttons and easy to read screen allows heating control adjustments to be made quickly and easily.

The advantage for the operator

The facility is delivered by a specialist ready for operation. After a simple introduction to the controls, the new owner will be ready to operate the system.

Economical



- 1 Large firebox with easy access door
- 2 Top down conical firebox
- 3 Electronic burner control panel
- 4 Gasification zones with cast iron grating and fireclay board
- 5 Hot tunnel made from heat resistant refractory brick for complete burnout
- 6 Large easy access ash box for grate ash
- 7 Vertical pipe heat exchanger
- 8 Top opening cleaning lid
- 9 Ash box below heat exchanger
- 10 Exhaust blower
- 11 Maintenance cover and burner connection
- 12 Safety heat exchanger
- 13 Lambda sensor

PYROMATECO
Width of load area 550 mm
Power output: 7 types from 30 to 85 kW

PYROMATECO
Width of load area 1080 mm
Power output: 7 types from 60 to 150 kW

PYROMATECO Burner connection

An additional oil boiler may be connected for backup or to cover holiday periods.
The PYROMAT is certified as an oil boiler in accordance with the latest EN standards.



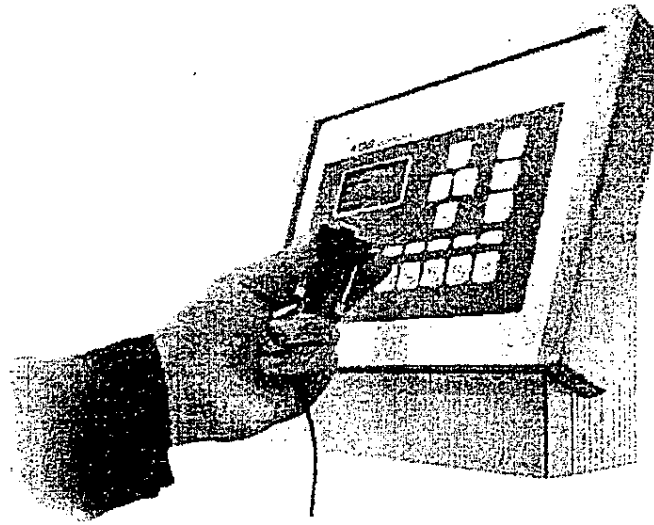
Plug and Play.

ECOTRONIC control system

The ECOTRONIC facility control system is a decentralized microprocessor system (CAN-BUS) with various modules connected to a data transmission line in a simple fashion.

Control module

The operating interface is organised in a simple and logical manner. The control module can be mounted either on the burner or on a wall.

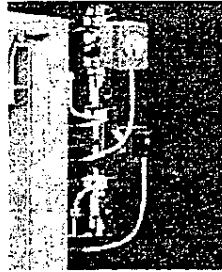


The ECOTRONIC as a boiler controller.



Firing controller.

The firing controller is built into the burner to control the motor-driven air vents by means of an integrated lambda probe. Internally, everything is already wired and ready to plug in. The result is a perfect output control system optimised in terms of emissions.



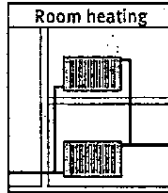
Burner group controller.

Keeping the return temperature up makes for a long service life of the burner. Conduction of heat to the accumulator, disconnection of the exhaust fan and closing of the air vents all go to guarantee the best possible protection against overheating. The burner group (pump and control valve) is mounted on the burner ready to plug in.

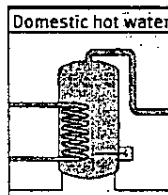
Advantages for the electrician.

The complete facility control system (including the control systems for all the heat consumers) comes from one source. Problem-free, simple installation of the modules ready to plug in.

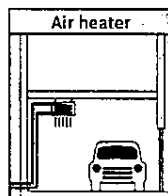
The ECOTRONIC as a heating regulator unit.



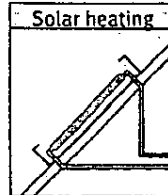
- Heating regulation controlled by atmospheric conditions with digital timer for a daily or weekly programme.
- Available on request with room thermostat
- ECOcircuit and frost-protection functions
- Simple setting of the individual heating curve



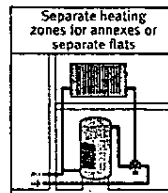
- Automatic reloading of the domestic hot water heater from the boiler or accumulator
- Quantity control with minimum return temperature for precise storage stratification
- In summer operation, up to 14 days' of domestic hot water available from the heat accumulator



- Quantity control with minimum return temperature for precise storage stratification
- Pump circuit with timer available (day and night programmes)



- When furnished by the sun, heat is conducted into the utility water heater or into the heat accumulator.
- This control system makes it possible for a maximum amount of heat to be transferred from the solar collector into the heating system.

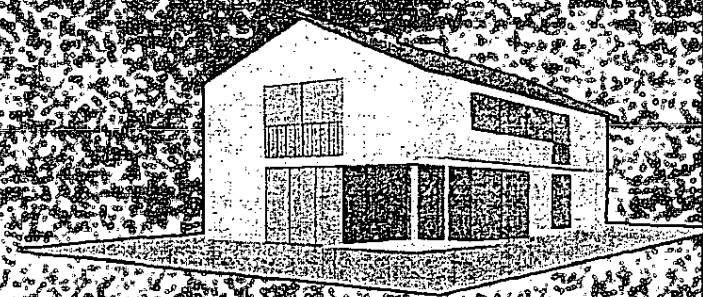
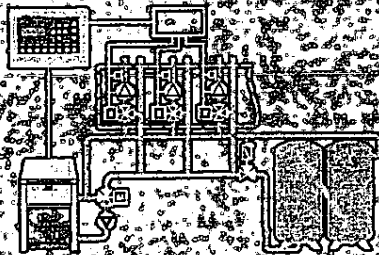


- Easy and efficient heat control for an annex:
- Using weather guided heating controls (as for main central heating)
 - At pre-programmed times (e.g. at night) more heat is diverted to the domestic hot water tank.

Using a distributor module and manifold, on the thermal distributor, the system can be expanded to as many as twelve zones.

Heating concepts.

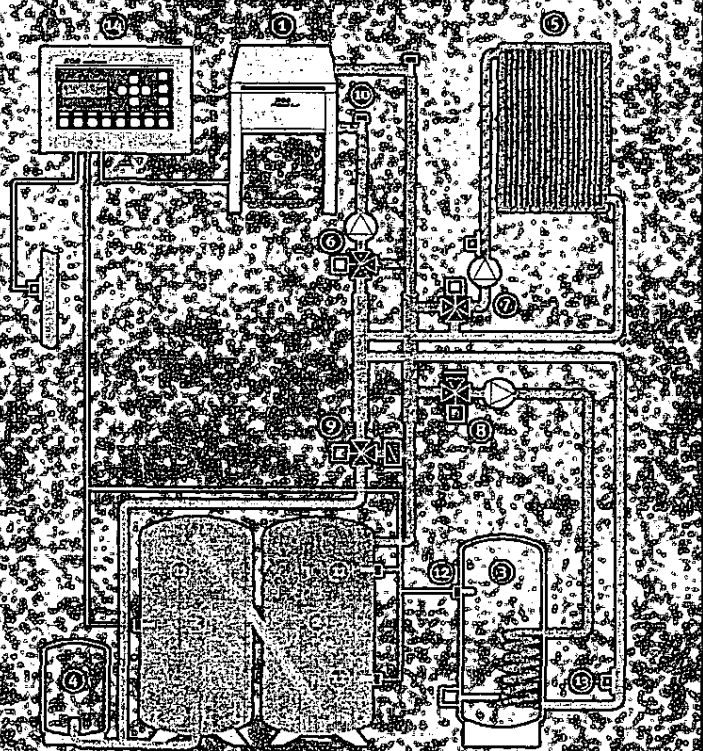
ECOTRONIC meets individual heating requirements. It can control up to 12 system groups.



Heat accumulator

- Perfect heating with logs requires an accumulator of sufficient size (mandatory since 2000 according to EN 303-5). Precise stratification of the hot water is necessary in order to make optimum use of it.
- The ECOTRONIC with its supplementary storage control valve provides an excellent guarantee of this function.
- As a result, solar energy can be used in ideal fashion in combination with log heating.

System with heat storage tank

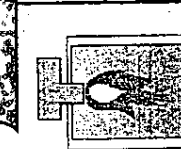


Heat management system (ECO-function)

- During the burning phase, the boiler heat not required for heating purposes is carried to the accumulator with precise temperature stratification.
- After burn-out, the residual heat in the boiler is completely used. KOB's exploitation of residual heat was honoured during the course of the Swiss campaign programme ENERGIE 2000.
- An additional yield of 9% per burn-out was observed in testing. Only after this is the heat supply carried out from the heat accumulator. The ingenious control modules for convenient heating discharge the accumulator with precise temperature stratification.
- This produces a supply of heat from the accumulator for the longest possible period of time.
- The automatic ignition system makes it possible to start the burner system with exact timing at the end of the phase.

- | | | |
|---------------------------|---------------------|---------------------------|
| 1 PYROMAT ECO burner | 7 Heater group | 11 Heat storage tank feed |
| 2 Heat storage tank | 8 Boiler group | 12 Boiler sensor |
| 3 Domestic hot water tank | 9 Heat storage tank | 13 Boiler return circuit |
| 4 Expansion tank | 10 control valve | 14 sensor |
| 5 Room heater | | |
| 6 Burner group | | |

Auxiliary burner



Auxiliary burner

Automatically switches to auxiliary burner to meet heat demands. Use as single unit or parallel to the wood burner.
Integrated return circuit valves in parallel operating mode.

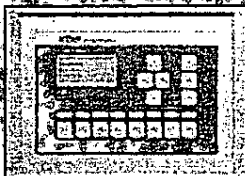
Full service...

The entire system is from the same manufacturer. This has many benefits. For one, all components of the KÖB system are tuned to function together as a complete heating system.

The operator is sure of the safety, reliability and quality of each component. Every system is the sum total of its components.

System components

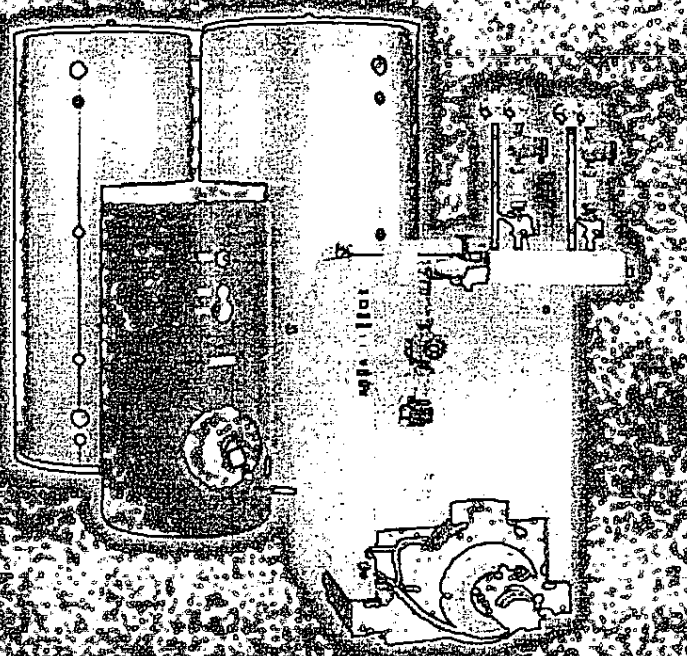
- Burner system with burner group (burner pump, burner control valve) is ready-to-plug. Includes ready-to-plug operating module, heat storage tank sensor and heat storage tank control valve.
- Burner accessories for special applications, such as firebox extensions and exhaust gas dedusters.
- Wall mounted heat distributors with control module for minimal wiring effort. With plug ready auxiliary burner system as a total solution - just connect it to the control module.
- An extensive range of high quality heat storage tanks and domestic hot water tanks. All sizes - even customized sizes - with accessories to feed in solar energy or for electrical recharging are available at short notice.



Proven technology

A KÖB heating system is a tried and proven high end, precision manufactured product built with first rate materials.

The PYROMATEGO is a next step development of the Pyromat that has been providing heat from wood in over 5,000 heating systems. All KÖB components are thoroughly researched and tested under the harshest conditions, then inspected and certified by the relevant authorities.



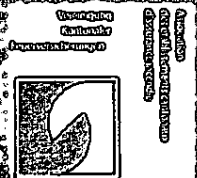
Certificates



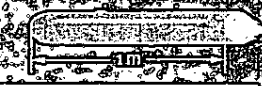
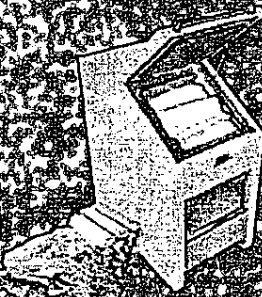
TUV - tested according to EN 303-5



Certificate Holzenergie Schweiz Nr. 0002



Test report EMPA certification VKF



Boiler type Pyromat	for heating requirements kW ¹⁾	Boiler output kW	Capacity Width mm	contents Liter	Ext. dimensions Height mm	Length ²⁾ mm	Width mm	Weight kg	Exhaust vent a in mm
ECO 35	14 - 32	35 - 40	550	185	1433	958	795	750	160-200
ECO 45	15 - 40	38 - 50	550	185	1433	958	795	760	160-200
ECO 55	18 - 48	45 - 60	550	255	1490	1163	795	920	160-200
ECO 65	22 - 60	55 - 75	550	255	1490	1163	795	935	160-200
ECO 75	24 - 64	60 - 80	550	255	1490	1313	795	1040	200
ECO 85	30 - 76	75 - 95	550	255	1490	1313	795	1065	200
ECO 61	24 - 68	60 - 85	1080	375	1433	1018	1324	1300	200
ECO 81	30 - 80	75 - 100	1080	375	1433	1018	1324	1320	200
ECO 101	36 - 96	90 - 120	1080	500	1490	1353	1324	1680	250
ECO 151	44 - 120	120 - 170	1080	500	1490	1353	1324	1720	250

¹⁾ At the operator's request and need for easy operations.
²⁾ With mounted exhaust blower plus 500 mm.